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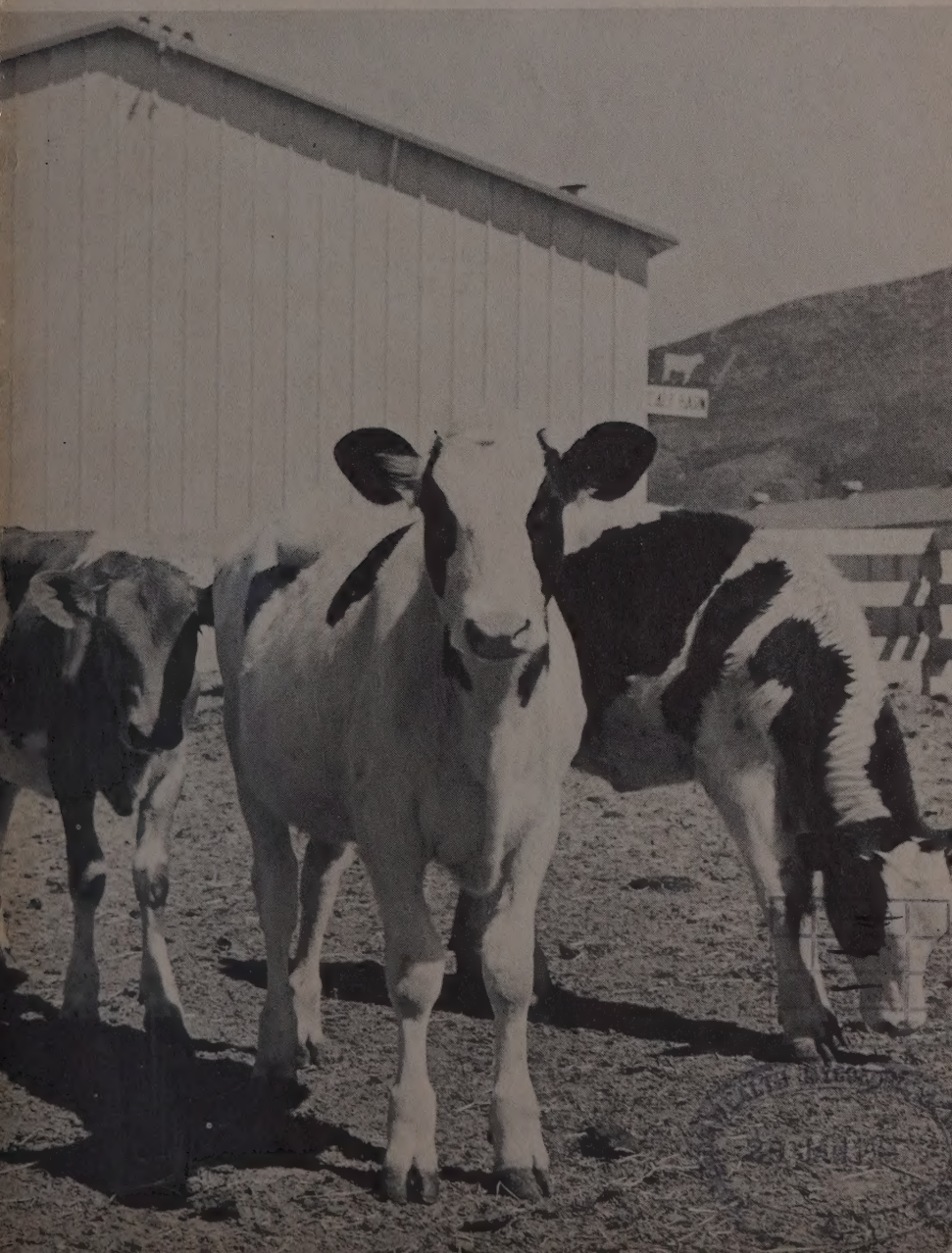

STATE OF CALIFORNIA
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QUARTERLY BULLETIN

Volume XLVIII Number 3

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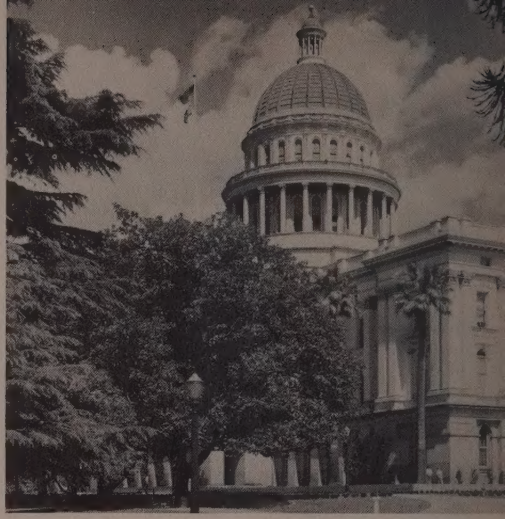

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The California

BRUCELLOSIS ERADICATION PROGRAM

The health of the cattle population is vital to the health and economy of the Nation. Clean, healthy dairy and beef herds help provide greater milk and meat production at a much lower cost. Eternal vigilance against all livestock diseases is an important part of efficient farm management.

The California
Brucellosis Eradication Program

By WILLIAM H. ROCKEY, D.V.M., Bureau of Livestock Disease Control, California Department of Agriculture

California is moving forward in a campaign to eradicate brucellosis from its cattle population. During past years, brucellosis has been one of the most costly diseases of cattle. Cattle that are affected often abort their calves, become sterile, produce weakened calves, have decreased milk supply and are generally unprofitable. In addition, humans can become affected with the disease which is sometimes called undulant fever.

California, in co-operation with the federal government, embarked on a brucellosis Certification Program aimed at eradicating the disease on September 23, 1957, as a result of a law enacted by Statutes of 1957, Chapters 2299 and 2310 by the California Legislature. The certification program is essentially the testing and retesting of all herds in a control area, the disposal of any cattle which react to the test, cleaning and disinfection of exposed premises, the controlling of the movement of cattle which may be exposed to the disease, plus the vaccination of all eligible calves. Immediately 15 northern counties made requests to enter into the control area program. Hearings were held by the State Department of Agriculture and the 15 counties were adopted as brucellosis control areas. Since that time, county after county has entered the program, and it is anticipated that the entire State will become a control area during the 1959-60 fiscal year.

California was well prepared for the eradication program inasmuch as the State entered upon a calf vaccination program January 2, 1948. As of June 30, 1959, 3,804,872 calves had been vaccinated. This calf vaccination program forms the "backbone" of the eradication effort and has been largely responsible for reducing the infection rate from approximately 17 percent in dairy cattle and 8 percent in beef cattle, as estimated by surveys, to below 1 percent as testing under the current program has revealed.

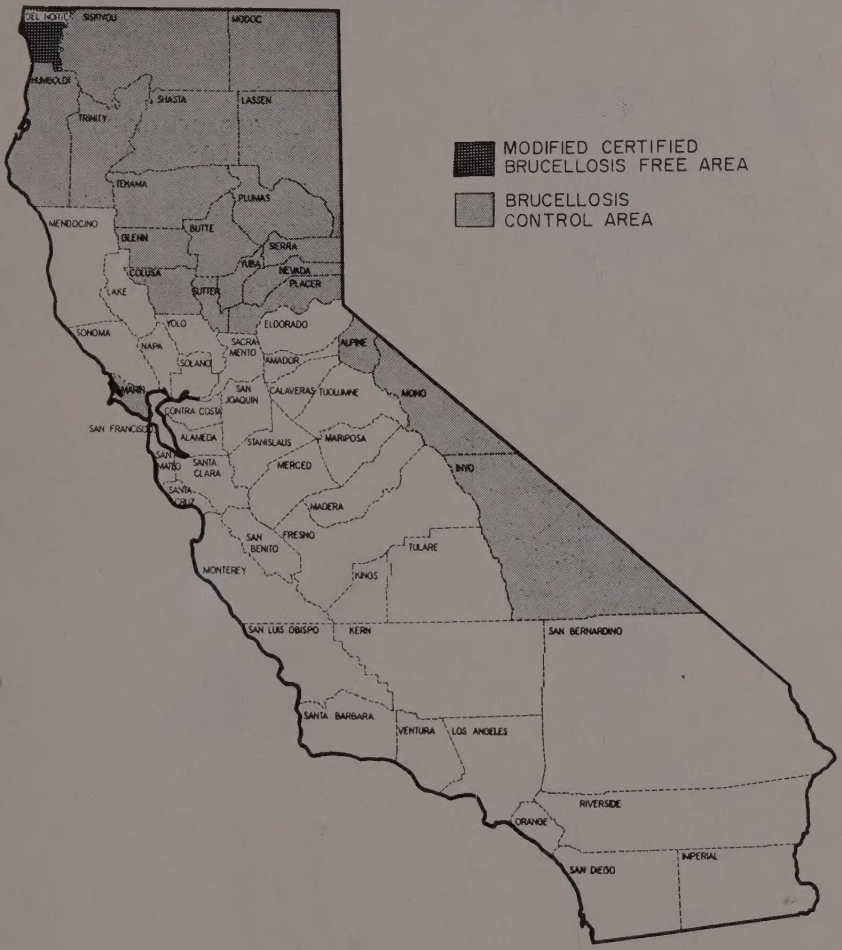
The program that is being carried out in California is keeping well abreast with the national developments. In 1954, a national accelerated program was launched by the United States Department of Agriculture in co-operation with the state livestock sanitary officials, to eradicate brucellosis in all states. Up to that time, only 341 counties, including three entire states were listed as modified certified brucellosis areas. As of June 30, 1959, 52 percent of the counties in the United States were certified including 19 entire states plus Puerto Rico and the Virgin Islands.

The California Eradication Program is administered through the Sacramento headquarters of the California Department of Agriculture, 10 state district offices, and federal offices in the State. The state district offices are located throughout the State so as to provide maximum service to the cattle industry and also to supervise the practicing, contract veterinarians who are the link between regulatory officials and the cattle owners. Practicing veterinarians who wish to participate in the program are given instruction on how the testing is conducted, preparation of test samples and reports. Following the instruction period, they are supplied with the necessary equipment and assigned areas in which testing is to be completed.

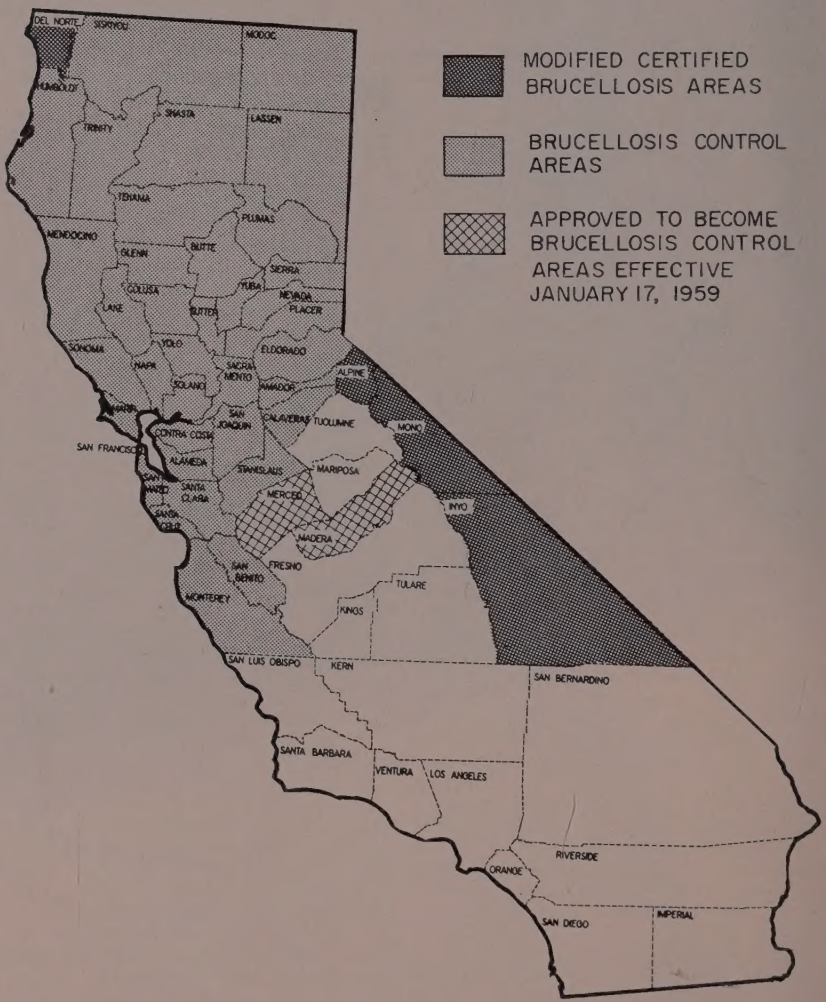
In control areas, testing of adult breeding cattle is required, also the vaccination of all female beef and dairy calves between the ages of 4 to 12 months. In noncontrol counties, vaccination of dairy calves is required, but the vaccination of beef calves is optional.

Testing is done in two ways. First, dairy herds are screened for evidence of brucellosis by use of the BRT (Brucellosis Ring Test). A composite sample of milk from each herd is tested with brucella antigen. Should a suspicious reaction be present, the

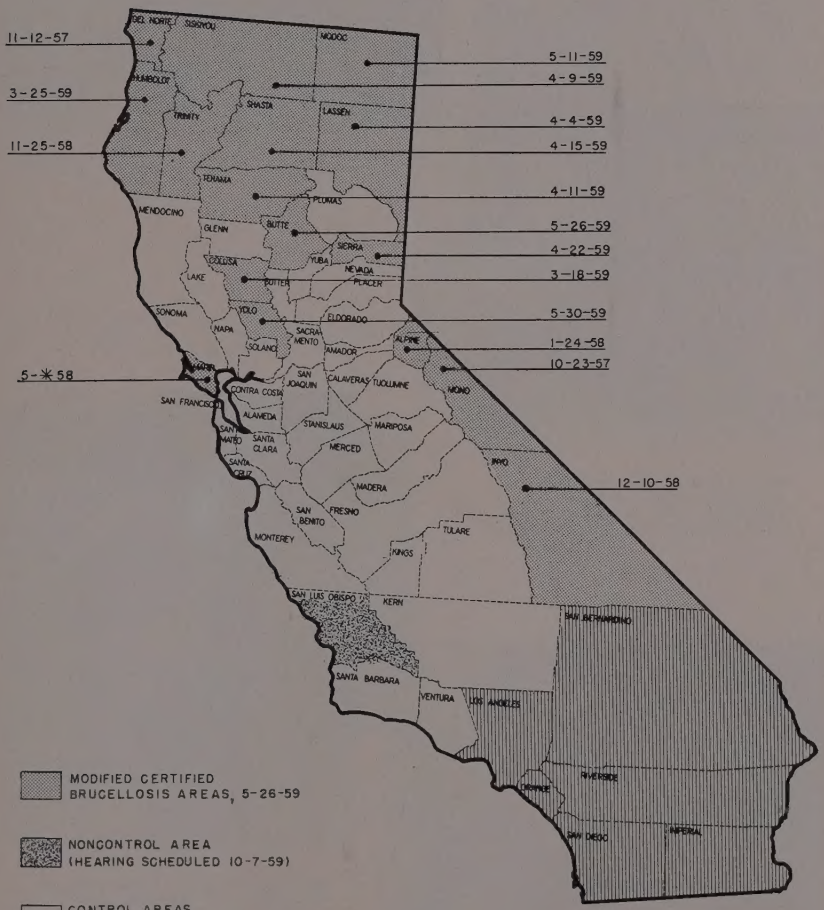
BRUCELLOSIS CONTROL AREAS
AND MODIFIED CERTIFIED BRUCELLOSIS FREE AREAS
AS OF DECEMBER 31, 1957



BRUCELLOSIS CONTROL AREAS AND MODIFIED CERTIFIED BRUCELLOSIS AREAS AS OF DECEMBER 31, 1958



BRUCELLOSIS CONTROL AREAS AND MODIFIED CERTIFIED BRUCELLOSIS AREAS AS OF OCTOBER 1959



MODIFIED CERTIFIED BRUCELLOSIS AREAS, 5-26-59

NONCONTROL AREA (HEARING SCHEDULED 10-7-59)

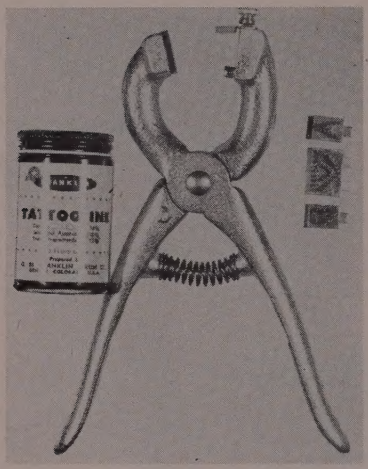
CONTROL AREAS, 9-1-59

CONTROL AREAS, EFFECTIVE 1-1-60

* ONLY DATE RECORDED INCLUDES OCTOBER 1958

2—5924

Calf being vaccinated against brucellosis. Five cubic centimeters of tested vaccine are used for each animal.



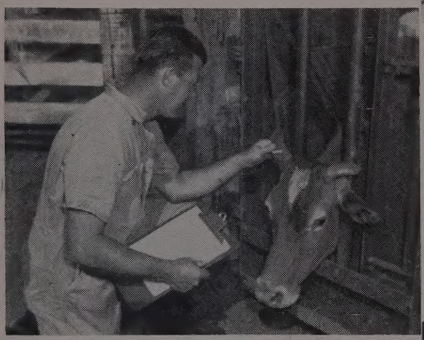
After a calf is vaccinated under the brucellosis control program, it is vaccinated with an official tattoo. Tattoo equipment is shown above.

Ring test samples being collected. Samples of milk from each dairy are collected at milk processing plants and sent to the laboratory for testing.

Blood samples are tested in laboratory using the standard antigen plate test. Positive reaction is evident by agglutination of the sample.

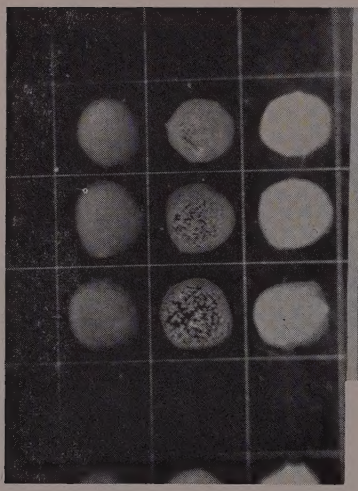
Blood samples are taken from each animal and individually identified before being sent to laboratory for testing.

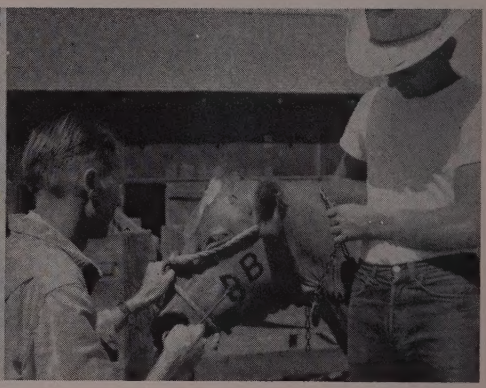
Ear tag being applied. All animals blood tested are ear tagged. No two tags are the same throughout the United States.



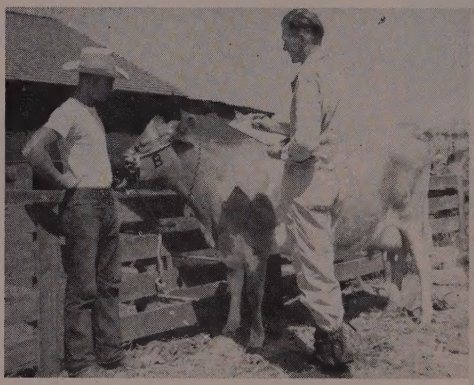
Each ear tag number is recorded on the test chart at the time the blood sample is taken.

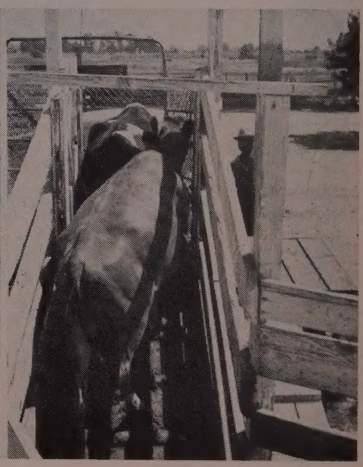
All animals are examined for evidence of having been vaccinated against brucellosis. An official tattoo is used to identify those vaccinated.





Blood agglutination test results (left). The columns on the left and right are negative. The light color of the right column is due to lighting effects when the photo was taken. The center column shows a positive reaction to the test. Differences in the center column are due to different dilutions used in the test. Animals reacting to the test are branded with a "B" on the left jaw (above).





"B" reactor being appraised by owner and representative from the State (above). Appraisal may also be done by a representative of the Federal Government. Reactors are loaded into truck for transportation to slaughter (right).

Meat inspector inspecting carcass of "B" reactor at slaughter house (right). Premises on which brucellosis reactors are found are thoroughly cleaned and disinfected after reactors are removed (above).

Animals imported into California are subject to inspection. Health certificates are checked by inspector (left). Cattle at salesyards are inspected for evidence of official vaccination prior to resale (below).

herd is then subject to blood testing, the second way of testing. Family cows and other dairy type cattle not included in the BRT are blood tested.

Commercial beef herds are subject to blood test only, and owners are required to present at least 20 percent of their mature cattle for testing except in purebred herds, where all eligible cattle over 12 months of age must be tested. If reactors are revealed, the entire herd must be tested. In all cases, animals officially vaccinated against brucellosis and under 30 months of age need not be tested.

The test samples are submitted either to a state or federal laboratory for testing. At these laboratories, trained technicians, working under the supervision of veterinary pathologists, complete the test. The testing is standardized between the laboratories and spot checks are made with the national federal laboratory in order that uniformity in results may be maintained.

If reactors are revealed, they are branded with a letter B on the left jaw, identified by ear tags in both ears and appraised. The appraisal is done by a state or federal inspector and the owner. It is based on the actual replacement value of the animal. Owners are indemnified by the state and federal governments for their reactors in accordance with laws and rules of each government. Indemnity payment is based on one-third the difference between the appraised value and the salvage of the reactor. The maximum amount the State will pay is $50 on grade cattle and $75 on purebreds. The maximum the Federal Government will pay is $25 on grades and $50 on purebreds. In all cases the owners receive the salvage value when the reactors are sold for slaughter.

Reactors are quarantined, immediately removed from the herd and sent to slaughter under a permit. The premises where the reactors were located are cleaned and disinfected under the supervision of a state or federal inspector. State or federal meat inspectors check the animals at slaughter and render a report certifying the animals actually were slaughtered. The balance of the herd is placed under hold order and retested after 30 days. When the herd has a clean test, the hold order is removed.

When all of the herds have been tested and the brucellosis infection is found to be below 1 percent in the cattle population and below 5 percent in the cattle herds, the county may be declared to be a modified certified brucellosis area, for a period of three years. As of September 1, 1959, 16 counties had been declared as certified areas and several others are expected to be given this rating within a short while.

All certified counties have been able to qualify as such on the first complete test or after one retest of the infected herds. A summary of the brucellosis testing for the 1959-60 fiscal year is shown in Table I.

When certification has been reached, the job is not finished. Eradication is the goal. A percentage of the herds must be tested every three years to maintain the modified certified brucellosis area status. The calf vaccination program must be followed closely by all cattle owners. Where infection is found it must be quickly eliminated. The California Certification Program is geared to involve the entire State during the 1959-60 fiscal year and all counties to be certified during the latter part of 1961 or early 1962. The rate of completion of the work however, largely depends on federal appropriations for the federal portion of administering the program, the federal indemnity on reactors, sharing in a portion of the calf vaccination work and reimbursing practicing veterinarians for the collection of test samples. During the 1959-60 fiscal year, the national federal budget for brucellosis eradication work was cut 25 percent, therefore, the program in California may not be expanded as rapidly as estimated if the federal allotment to California is cut in accordance with the national reduction.

TABLE I

	Herds	*Cattle tested*	*Cattle represented*	*Reactors*	*Percent cattle represented*
Dairy	9,090	223,579	491,371	3,937 *	.8%
Beef	3,475	131,595	332,155	1,472	.4%
Total	12,565	355,175	823,526	5,409 *	.7%

* Includes 178 adult vaccinates.

The European Starling in California

By WALTER E. HOWARD, *Specialist, Field Station Administration, University of California, Davis*

FOREWORD

Walter S. Ball, Chief, Bureau of Rodent and Weed Control and Seed Inspection, California Department of Agriculture

Due to its rapid increase in numbers over the past few years, the starling (*Sturnus vulgaris*), has been of much concern to California farmers. Although large flocks have been observed in this State only during the winter months, crop damage has not been reported. Should the birds take up permanent residence, it is quite possible they would cause fruit and other crop losses. Dr. Howard's paper gives valuable information on the European starling, and will be most helpful to those agencies and individuals interested in the bird's identification, life history, habit requirements, economic status, potential hazard, and control.

The starling (*Sturnus vulgaris:* Family Sturnidae), a native of western and central Europe, continues to extend its range in North America, especially in the west. This bird is now distributed throughout most of the world. It was first reported in California in 1942. At first, only small numbers were seen, usually with blackbirds or meadow larks, but during the 1950's, the number of winter-visiting starlings in the State grew from a few birds to thousands—with flocks of 25,000 and 50,000 birds, in the Sacramento and San Joaquin Valleys, respectively, in 1957 (Atkinson, 1958). As of 1958, there has been no large scale nesting of starlings in California. According to Ball and Koehler (1959: 155), in 1958 there were "reports of nesting attempts from San Bernardino, Mono, San Joaquin, and San Luis Obispo Counties. The San Luis Obispo County report includes a picture of the female at the nest site and the statement that six young taken from the nest May 26, 1958, were preserved as specimens. These young appear to be in two age groups. There have been nesting attempts in former years in Modoc County, as early as 1949, and more recently in July of 1956, adult birds were seen feeding young at the town of Likely." This follows the pattern typical of starling invasion of other parts of the world: starlings migrate in and out of a new area for perhaps 5 to 20 years before taking up permanent residence. Evidence indicates that dispersal of the species is accomplished primarily by birds of the year (Thomas, 1934). The density of resident populations in California can be expected to increase slowly and then explosively—just as occured with winter visitors. That the starling will become abundant in California seems assured, for almost everywhere that it has been introduced, its adaptability has enabled it to thrive.

The extension of the starling's range in North America has been well summarized by Forbush (1920), Cooke (1925 and 1928), Lewis (1927), Hoffman (1930), Kalmbach (1931), Dickerson (1938), and Kessel (1953a). Although attempts were made to establish the bird as early as 1872, the starling apparently first became established in North America when it was introduced into Central Park, New York City, in 1890 and 1891. Table I lists the reports of starlings in western North America.

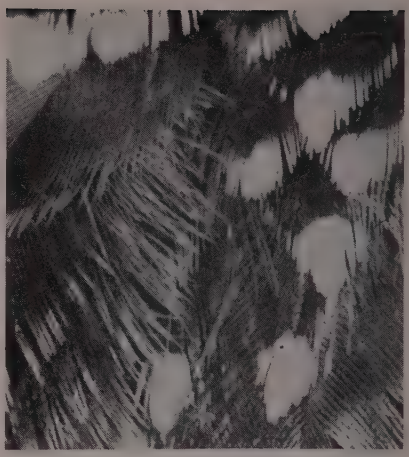
This paper was prepared at the request of the California Department of Agriculture to provide up-to-date information on starlings—their spread into western North America and California, the potential hazard to California's diversified agriculture based on experiences elsewhere in the world, and what might be done to alleviate the threat to the California crops that are vulnerable to starling damage. More than 200 references were examined, but little really new and pertinent information was found more recent than the major reports by E. H. Forbush (1920: The Starling), E. R. Kalmbach and I. N. Gabrielson (1921: Economic value of the starling in the United States), H. F. Lewis (1927: A distributional and economic study of the European starling in Ontario), and E. R. Kalmbach (1931: The European starling in the United States). The most noteworthy economic study of the starling since these early works is a comprehensive investigation by the Australian H. F.

Thomas (1957: The starling in the Sunraysia District, Victoria). The most recent analysis of the spread of starlings into western North America is by Brina Kessel (1953a: Distribution and migration of the European starling in North America).

Identification

The starling looks like a short-tailed blackbird. It is difficult to identify only because it is wary, thus preventing close scrutiny. "The adult starling is about 8½ inches long, and its weight is about equal to that of a robin; but its short, drooping tail gives it, when at rest, a chunky, hump-backed appearance. From early spring until the middle of June, the adult bird may be singled out at a distance by its being our only blackbird having a rather long, sharp, yellow bill" (Kalmbach and Gabrielson, 1921). From late July until January, most of the birds have a dark bill; in fact, Nichols (1945), found that only from May 29th to June 10th, were the bills of all adult birds completely yellow, with no trace of dark.

Lewis (1927), provides a good description of the starling: "In summer the adult male starling has the head, neck, back, breast, and upper belly black, with metallic purplish or greenish reflections; numerous cream-buff spots, caused by cream-buff tips to the feathers, on the upper parts and sides; wings, tail, lower belly, and undertail-coverts dark brownish gray, edged with cream-buff; bill yellow; feet and tarsi brownish. The female in summer is similar, but is spotted with cream-buff below as well as on the upper parts and sides. In winter, individuals of both sexes have the bill dark brown, the upper parts heavily spotted with brownish cream-buff, and the entire under parts heavily spotted with white. Young birds, when they leave the nest, are a uniform dark olive-brown, except for a white or buffy throat and a few light streaks on the under parts. The length of the starling is about 224 mm., and its usual weight is about 88 grams.



Close up view of feathering of the European starling.

European starling (*Sturnus vulgaris*). Note size in relation to six-inch ruler at the left.

"While the starling is commonly so wary as to make close observation in the field difficult, it may be distinguished readily at a distance by one familiar with it. The spots in its plumage are seldom apparent, except at close range, so that it usually appears to be a plain blackbird. The somewhat grayish undersurface of its wings is sometimes noticeable when the bird is in flight * * * When approaching a perch, the starling often sails for some distance on fixed wings, but at other times its flight, which is fairly direct, is commonly maintained by characteristic rapid wing beats. On the ground the starling walks rather quickly and nervously, seldom pausing except to snatch a morsel of food.

"The starling utters a number of characteristic call notes, none of which is very

loud or conspicuous. Its song, which is usually delivered from some high perch, consists of a series of more or less musical squeaks, whistles, and chuckles, continuing in leisurely fashion for an indefinite length of time, and often interspersed with imitations of songs and call notes of other species of birds. The song is often uttered in winter, as well as in the breeding season. The imitations of the notes of other birds appear to be learned anew in each generation, as starlings in North America imitate notes of North American species; not those of European species."

Mayfield (1942), reported that he identified starlings imitating 34 different species of birds.

Life History

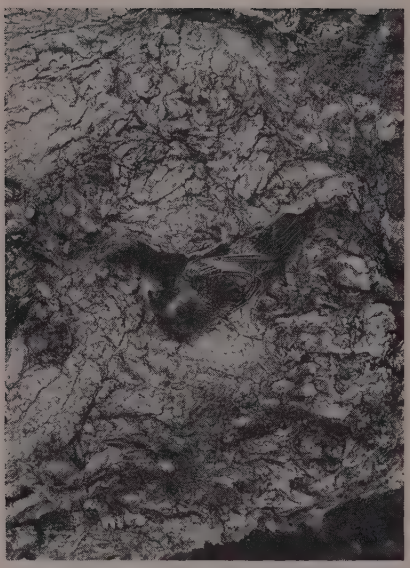
Starlings commonly lay three to six pale bluish eggs. They generally have only one brood a year (Hicks, 1935), but sometimes two, and occasionally three (Hicks, 1935, Kessel, 1953b). Incubation takes 10 to 11 days, and the young remain in the nest about three weeks. Nestlings are fed chiefly insects and other small animal life (Kalmbach and Gabrielson, 1921; Lindsey, 1939; Thomas, 1957). Weight ranges for about 2,000 birds were 73 to 96 grams for males and 69 to 93 grams for females (Hicks, 1934).

After the young birds leave the nest, they begin to gather in flocks that by midsummer may contain thousands. Adults usually do not assemble in these flocks until late in the breeding season, although adults may be found roosting with the younger birds. Summer roosts are usually in trees, but may be on buildings or in cattail marshes. In fall and winter, roosts are likely to be on buildings. Other birds may share the roosts. Marples (1934), reported that the greatest distance accurately measured between feeding grounds and roosts was 30 miles.

Nests are usually located in some sort of cavity in trees, ceilings of buildings, cliffs, and river banks. Starlings usurp the nesting sites of native birds that nest in hollows. Howell (1943), for example, reported starlings driving flickers from their nest and killing downy woodpecker young in the nest. Starlings have also been observed preventing sparrow hawks from nesting (Von Jarchow, 1943). Dickerson (1938), said that the most serious threat of starlings to native song birds is probably their tendency to congregate during late winter and early spring in large migrating flocks, which effectively clean up all available reserve foods just before and during the northward migration of many species.

Starlings are predominatly insectivorous, although they must be classified as omnivorous in their feeding habits, for they also eat seeds, fruits, berries, and green vegetation, as well as small insect-like animals (Lindsey, 1939; Hamilton, 1949). From analyses of 2,157 stomachs of adult starlings in Northeastern United States, Kalmbach and Gabrielson (1921), showed that 57 percent of the starling diet was animal matter and 43 percent was of vegetable origin. From April to November (except for July, when mulberries and cherries made up 50.7 percent of the diet), the birds fed primarily on insects and other animal matter. From December to March, animal food made up only 31.5 percent of the diet.

Typical flight pattern formed by the starling. The long narrow dark band across the photo is a flight of thousands of starlings.



Starling at nesting hole in a tree. Photo courtesy of National Publicity Studies, New Zealand.

Habitat Requirements

Starlings are widespread in much of the world, and apparently can adapt themselves to quite a variety of cold, hot, wet, and dry conditions. Both water and pasture land irrigated for grazing livestock have a strong attraction for starlings. The birds are frequently associated with sheep, cattle and horses. Dairies with irrigated pastures provide desirable feeding grounds. Shallow water and muddy patches of ground following receding irrigation water are favorite gathering places for these birds. At one season or another most of the agricultural areas of California appear to be suitable habitat for starlings.

Economic Status

I do not wish to term the starling either "good" or "bad," for this is a relative matter, dependent on how it affects one's own livelihood. But, I will raise some questions as to whether we want this species in California.

About the only point in favor of this uninvited newcomer is that it has academic interest to ornithologists. It is not much of a songster, and it usurps the nests of other birds. It eats seeds of weeds—and of beneficial plants too—and spreads both by voiding viable seeds. It destroys many injurious insects, but also devours predatory and other beneficial insects. The eating of insects is most likely to be beneficial in pastures.

Most of the starling's activities are irritating to man. Kalmbach (1932), expressed city dwellers' feeling toward the bird in a reference to Washington, D. C.: "Here the shopper and shop owner; the pedestrian and autoist; the bird hater and even bird lover periodically join the chorus of damnation. Even the staid ranks of profound ornithologists have echoed the song of lament."

The most serious objections raised by the greatest number of people is to the noise they make and to the smelly and unsightly contamination of roosts on buildings. Starlings compete with other birds for food, and may influence the survival of less adaptable species. They sometimes concentrate in trees in such numbers that major limbs are broken or the trees are killed from the accumulation of droppings. They possibly carry foot-and-mouth disease, avian tuberculosis, lice that cause human skin eruptions, and other diseases. Their habit of nesting in ceilings is a fire hazard, insanitary, and often a nuisance in other ways.

Thomas (1957), gathered information from many authors: The farmer is compensated for starling damage by the large number of injurious insects destroyed (Leigh, 1916). The starling is useful, especially on grasslands, but local damage is often so great that control measures are needed (Van Paetesen, 1929). The starling destroys noxious insects, but is a dangerous enemy to fruit culture (Hooper, 1907). Because the bird is omnivorous, its influence on the frequency of any insect cannot be great, for it captures whatever comes most easily, whether injurious or beneficial. Moreover, the mere eating of noxious insects does not prove that the starling is of great economic importance (Kluner, 1933). Although the starling eats considerable amounts of corn during the fall, the damage is counterbalanced by its eating noxious insects (Marples, 1933). In New Zealand, besides eating injurious insects, the starling eats the eggs of the skylark, a bird that is objectionable because it eats grain (Oliver, 1930). Even though the starling eats considerable wheat, it probably does more good than harm (Kelso, no date given). The starling is the farmer's friend in spring, but in summer and fall raids fruit—particularly ripe

pears (Coward, no date given). The starling's powers of rapid local concentration can make it a serious pest to the grower of soft fruits (Nicholson, 1951). Chisholm (1926), was satisfied that the starling was beneficial, although it attacked fruit at times; Slaney (no date) said he knew that the starling is troublesome to fruit growers, but that its value to other agriculturists and to pastoralists is inestimable. The situation in South Australia is difficult to judge, but Jenkins (no date) thinks the starling is dispensable, since it damages nearly all classes of fruit, sometimes stripping fig and mulberry trees of their entire crop. He said: "However useful an insect-destroyer the starling may be, it must also be remembered that were the starlings not so numerous, we would have more native insect eaters, which would not take such heavy toll of the fruit crops as the starling takes."

Thomas (1957), observed in his Australian studies: "As they ripen, some of the softer varieties of tree fruits have an almost irresistible attraction for starlings. For example, many of the individual mulberry trees * * * are visited annually, as are certain of the figs, and—rather surprisingly—olives. Currants were found to be harmed principally on the vines, and frequently before they were completely ripe, whilst sultanas and gordos were affected both on the vines and on the racks. Sultanas, particularly, were also taken while on hessian on the ground. Injury to some wine and table varieties was also disclosed. Raids on vineyards are usually of short duration, and at these times, the birds are constantly on the alert, and will flush at the slightest provocation. They are wasteful feeders where grapes are concerned, and, apart from that eaten, a large quantity of fruit is bruised and broken on the bunch, or scattered on the ground beneath the vines. The stomachs (400) of very few of the birds collected contained grapes only; practically all contained at least some insect matter as well. There is evidence that some, if not all, starlings may regard grapes as a kind of 'dessert' rather than as a 'main course'. Attacks on vineyards are frequently more intense after windy weather, and at certain times, possibly when other food is short, the birds will repeatedly return to a vineyard despite almost continual gunfire. No evidence was found to support the contention that a particular peak feeding period exists—birds appear to eat when they are hungry, regardless of the time of day. It is of great interest to find that so little grain was eaten as such by Sunraysia (District) starlings, at any rate during the year of the investigation. This is all the more remarkable in view of the findings of Kelso, Collinge (1921) and others, all of whom showed that grain formed a considerable part of the food of these birds.

The following comments about starlings in the British Isles are from Lewis (1927). He quotes one person's opinion: "I never once heard a farmer say a word against the bird. When he saw two or three thousand in his fall wheat field or any of his meadows, he knew there were 'grubs' there—his wheat came up just the same next spring, although an army had been over the field with a fine tooth comb—not in search of his grain, but insects and such like, injurious to grain." Lewis also comments that in Ireland they are looked upon as useful since they are very active in the consumption of worms, grubs, and insects, and follow the plough. While lawns and open meadows are more in their line as feeding places, they never go into growing crops, which would spoil their view and lead to a surprise. He says that the starling is also a fruit-eater, particularly of cherries; and in winter, when insect food is scarce, he will eat berries, seeds, and grain.

Collinge (1919), wrote that the starling offers a most serious menace to the production of home-grown food. He also said (1921): "For many years past there has been taking place a sure but gradual change of opinion with reference to the economic status of the starling, for from one of our most useful wild birds, it has become one of the most injurious. Its alarming increase throughout the country threatens our cereal and fruit crops, and the magnitude of the plague is now fully realized. As the number of starlings has increased annually, a gradual change in the nature of the food consumed by these birds has taken place. There is fairly reasonable evidence to show that in the past, the bulk of the food consisted of insects and insect larvae, slugs, snails, earthworms, millipedes, weed seeds, and wild fruits; in more recent years, this has been supplemented by cereals and cultivated fruits and roots."

Field observation of starlings feeding in Ontario are relatively few. According to Lewis (1927), they feed on frozen apples

hanging in the trees, larvae of European corn borer, waste grain of no value, wild grapes, which are their chief food at that time, mountain ash, berries, and apples that are sound fruit and still on the trees. The birds made numerous holes in the apples that they attacked. Lewis also reports the following from a Plymouth (England) newspaper: "That practically the whole of a seven-acre wood * * * which lies in a very sheltered spot, and is about 15 years old, is composed largely of conifers, spruce and larch. From time to time, these have been black with millions of starlings, whose attentions have been so injurious to the comparatively young trees that of the original number, about two-thirds have been killed. Bands of local inhabitants have stood in the woods and created all manner of noises to frighten the birds away, but they return at dark, and then nothing will keep them out. Thousands of them have been shot, but still many more thousands come. Luckily the damage done to outside crops is not very much, although they have been known to eat the corn just as it was bursting through the ground."

On the continent of Europe, the starling is generally regarded with favor because of its insectivorous habits, although it is acknowledged to do some damage to cherries, grapes, olives, and other fruit. German and Hungarian authorities are particularly favorable in their estimate of the starling's worth (Lewis, 1927).

With regard to starlings spreading diseases, one can see Bullough (1942) and Wilson and Matheson (1952). The latter said: "We conclude that available evidence is adequate to establish a *prima facie* case against birds, and especially starlings on migration, as a means whereby foot-and-mouth disease is introduced into Britian; further that the frequency of its introduction is dependent on the extent of the disease in certain coastal areas of the Low Countries and Northeast France at the season of bird migration. No other British bird, whether native or migrant, shows such an affinity for close contact with livestock as does the starling. When ground is contaminated with infected saliva, the chances of picking up infection or otherwise becoming contaminated need no elaboration. Starlings have a further feature distinguishing them from most other species which may have a bearing on their disease-spreading propensities. In roots, which may contain up to 50,000 starlings, the birds are huddled so closely together that infection could readily be transferred from bird to bird. Summarizing the foregoing on the basis that birds are mechanical vehicles in the transmission of virus, the starling by its habits and numbers is an obvious choice as chief suspect." Other diseases that starlings may transmit include histoplasmosis, toxoplasmosis, and psittacosis, but little research has been done in this area (personal communication from J. R. Hay). In Texas, starlings have been responsible for the transfer of mites and other parasites to pigeons and domestic fowl (personal correspondence from E. T. Dawson).

Cottam (1944), pointed out that in Queensland and New South Wales, Australia, the starling is credited with preying extensively on sheep ticks and sheep maggot flies on the backs of sheep. It has been condemned for pulling wool from the backs of sheep. Cottam also said that in New Zealand it is reported to help control the cattle tick. "In its native England, the starling has been praised for destroying larvae and adult horseflies, cattle and sheep flies, and for feeding on ticks from the backs of sheep. From various parts of its range in the United States (Nebraska to the Atlantic Coast), the bird has occasionally been observed feeding on the backs of cattle or other domestic livestock (Goodrich, 1940); until the winters of 1937 and 1938 such feeding caused only favorable comment. This would seem to be a beneficial habit; often, however, in probing for the grubs, the birds develop a taste for raw meat and blood and continue to feed on the flesh of the live animal. Infection and loss of livestock not infrequently occur. In addition, damage is caused by stampedes resulting from the presence of flocks of the birds in the neighborhood of cattle previously attacked; this is a problem of considerable importance in livestock circles." Other references on this include: Astle, 1940; Lake, 1940; Goodrich, 1940; Wells, 1940; McCoy, 1941; Moreton, 1943. G. C. Halazon (personal communication) reports that in Kansas all investigations of starlings causing grub damage on heavily infested cattle have been negative.

Potential Hazard to California

It is not easy to predict the degree that starlings will become a general nuisance and an economic problem to agriculture in Cali-

fornia. However, a few generalities appear warranted from the behavior of starlings in other countries and from answers to a questionnaire sent to the director or commissioner of agriculture in each state in the United States (Table 2). (Grateful acknowledgment is extended to the many people who filled out the questionnaires and provided other helpful information.)

Breeding populations of starlings are certain to become a serious nuisance in California, probably within the next 5 to 20 years—especially in cities, because of their noise and messy roosting habits. Moreover, starlings will probably cause some local crop damage that is more severe than that caused by any other bird now present in California. It is improbable, however, that all of any one type of crop throughout the State will suffer serious starling damage in any single year. However, in terms of aggregate damage, it does seem likely that the starling will become our worst bird offender, both in cities and on farms.

As shown in Table 2, serious, but local, damage can be anticipated for most or all grains, with sorghums and corn possibly receiving the greatest damage. Since starlings are attracted to water, I suspect rice will also be damaged seriously, at times. Of fruits, sweet cherries will probably suffer more than sour cherries, and sweet eating grapes more than sour wine grapes, but most cherries and grapes will be vulnerable. Other fruits likely to be seriously attacked at times include figs, olives, pears, apples, peaches, and all types of bush berries. The fate of apricots, avocados, and plums is unknown. It is hard to predict what vegetables might suffer local damage from starlings, but strawberries, tomatoes, and sweet corn certainly are likely candiates. Winter flocks may at times attack fall or winter seeded alfalfa, lespedeza, and other seed crops and cereals.

Control Methods

The best references found on methods of starling control are by Kalmbach (1945 and 1954). The first mentioned is a free leaflet, obtainable from the Fish and Wildlife Service, U. S. Department of the Interior, Washington, D. C., which discusses various ways to screen starlings from buildings; eliminate roosting ledges; trim trees to discourage the birds (one city recently cut down all the trees around the courthouse to get rid of starlings); frighten them with fire hoses, guns and other aids; and destroy them by shooting, trapping, capturing at enclosed roosts, gassing, and poisoning. Lovell (1941) developed a noise-making device, and Frings and Jumber (1954), obtained local success in frightening starlings by playing recorded starling distress calls over loud speakers when the birds came in to roost.

In general, the problem is much the same as with many other California birds. There is no easy answer. County agricultural commissioners should be consulted about particular problems. Research on control of starlings needs considerable expansion, as is the case with nearly all vertebrate pests. Research on vertebrate pest control has not kept pace with research on weed and insect control.

To delay a starling build-up in California, the public might be taught to identify starlings and to destroy their nests. In addition, wholesale reduction of starling numbers should be attempted at their large winter roosts.

Conclusion

Even though the starling may be unwanted in California, it is now here, and there is little chance of extirpating it. Introduced into New York City in 1890, it has spread its range over most of North America. Large winter flocks of up to 50,000 birds have been seen in the State, and these numbers will be common when nesting is widespread in California.

The starling, a wary bird, looks like a short-tailed blackbird. In summer the adult has a yellow bill, which helps identify it. The starling is not a noted songster, though it imitates many birds. It usually nests in cavities of some sort.

Starlings are not popular. They usurp the nesting hollows of other birds. The large winter flocks are a great annoyance because of their noise and mess. Sometimes communal roosting even kills trees with the accumulation of excrement. Starlings may carry a number of diseases, such as foot-and-mouth disease, avian tuberculosis, histoplasmosis, toxoplasmosis, and psittacosis.

Even though starlings are predominantly insectivorous, at times they do considerable agricultural damage by feeding on seeds, fruits, berries, and green vegetables. California crops, of which starlings may become the worst bird offender, perhaps in 20 years,

include cherries, grapes, olives, figs, and all types of bush berries. Starlings may also seriously damage apples, peaches, pears, (apricot, avocado, and plums unknown) sweet corn, strawberries, tomatoes, sorghums, and other grains, and winter-sown alfalfa, lespedeza, and other seed and pasture crops. They are not known to damage citrus or nuts. Their effect on most vegetables is unknown.

Although starlings are adaptable to a wide variety of habitats, they are especially attracted to irrigated pasture land. They are frequently associated with sheep, cattle, and horses.

Starlings will be as difficult to control as many other bird offenders in California. Anything that will delay the rapid increase of starling numbers, such as their destruction at winter roosts, will help to postpone many economic and nuisance problems.

TABLE I

Earliest (?) Recorded Observations of Starlings in Western North America

Locality	*First seen*	*Author*	*First nesting*	*Author*
Texas	1926	Dickerson (1938)		
Oklahoma	1929	Dickerson (1938)		
South Dakota	1933	Lundquist (1934)		
Colorado	1938	Rockwell (1939)	1943	Breiding (1943)
Nevada	1938	Cottam (1941)	1956	Gullion (1956)
New Mexico	1939	Allan (1939)		
Utah	1939	Lockerbie (1939)	1949	Kessel (1953a) and Behle (1954)
Montana	1940	Moos and Graves (1941)	1943	Mills (1943)
Saskatchewan	1940	Furniss (1944)		
Idaho	1941	Olson (1943)		
California	1942	Jewett (1942)	1949	Ball and Koehler (1959)
Oregon	1943	Jewett (1946)	1950	Quaintance (1951)
Washington	1943	Wing (1943)	1951	Hudson and King (1951)
Arizona	1946	Monson (1948)		
British Columbia	1947	Munro (1947)	?1950	Racey (1950)
Alaska	1952	Kessel (1953a)		

TABLE II

Probable Starling Menace to California Crops

Crop and Probable Starling Damage			
Apples	Serious	Nuts	None
Bush berries	Worst*	Rye	Serious
Cherries	Worst	Wheat	Serious
Citrus	None	Rice	Serious
Figs	Worst	Corn	Worst
Grapes	Worst	Sorghums	Worst
Olives	Worst	Oats	Serious
Peaches	Serious	Barley	Serious
Pears	Worst	Millet	Serious
Sweet corn	Worst	Alfalfa	Serious
Strawberries	Serious	Lespedeza	Serious
Tomatoes	Serious	Legumes	Unknown
Many vegetables	Serious	Field crops	Unknown

* Indicates that starling may become the worst bird offender on this crop.

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California's Milk Fat Testing Program Of Bureau of Dairy Service

Includes Many Safeguards for Protection of Producers and Processors

By A. E. REYNOLDS, Assistant Chief,
Bureau of Dairy Service, California Department of Agriculture

The importance of the Babcock test to the milk producer may be better understood when we consider that California dairymen were paid about $348,153,000 for milk in 1958. This amount was determined by the weight and milk fat test of the milk produced and the contract price or market value. All pricing formulas used to determine milk value are based in part on the milk fat content. In some instances the fat content, as determined by the Babcock test, is the *only* factor used in milk purchases.

Producer and processor alike have a big stake in the operation of the Babcock test for each is vitally interested in one thing, accuracy. A milk processor can go broke in a hurry if, through sloppy testing methods, he overpays the producer or is careless in making fat tests used for the purpose of standardizing fluid milk to a uniform fat content. The producer, of course, could not stay in business long if he is not paid in full by the processor for the total amount of fat which he sends to market.

The California Legislature has recognized the importance of the Babcock test in the economics of the State's dairy industry. As early as 1915 California lawmakers passed legislation providing for penalties against any person found by our courts giving false tests when using the Babcock method. In 1917 a law was enacted which prescribed penalties for giving false weights of milk or cream and requiring testers to be licensed. Not until 1925 were all persons weighing and sampling milk and cream required to be licensed.

Today the buying and selling of milk and fluid dairy products on the milk fat basis is strictly and constantly supervised. The Bureau of Dairy Service, California Department of Agriculture, employs five inspectors who work full time enforcing the provisions of the Agricultural Code relating to testing, weighing and sampling of market milk and cream.

The purpose of this article is to explain the Bureau of Dairy Service activities in this program.

Laws dealing with weighing, sampling and testing are found in the California Agricultural Code, Chapter 8, Section 685 to 689, inclusive, and Article 13 and 14 of the Administrative Code. These Agricultural Code statutes define false tests, records, samples, payment basis, tolerances and required accuracy in glassware used.

The Administrative Code states the details on examinations, sampling and weighing, test room equipment, accuracy in weighing and measuring test charges, operating the centrifuge, reading tests, keeping records and character of work.

All together there are 14 printed pages in the two state codes which regulate every detail of weighing and testing the producer's milk from the time the sample is taken until the paycheck is issued to him.

The men assigned to carry out the provisions of these laws are well qualified for the task. They are chosen from a state civil service list after successfully passing both a written and an oral examination. They must possess proper educational background and have the necessary experience in the subject. They also receive on-the-job training in public relations, work improvement methods and human relations. The bureau puts considerable emphasis on the study of human relations because these men are con-

stantly dealing with people who have likes and dislikes, feelings and who want the security that goes with the knowledge that they are getting a "square deal."

The inspector must inspire confidence in himself and his integrity. He must take time to work patiently with people's problems, large and small. He must have the resourcefulness and capacity to investigate complaints, carefully searching out the facts and arriving at a solution or satisfactory explanation. He must be a man of action who believes in the importance of his work. He must never be satisfied with or tolerate sloppy testing methods or slipshod weighing or sampling.

The state law requires that each person who weighs, samples or measures milk or cream as a basis for payment secure a weigher's and sampler's license from the Bureau of Dairy Service. The applicant is provided with study material which is useful to him in preparing for the examinations, both written and oral. The oral part of the examination consists of a demonstration of correct weighing and sampling methods. The 1953 samplers and weighers presently licensed are checked frequently to make sure they conform with all regulations.

Any willful violator is either prosecuted or is ordered to show cause why his license should not be suspended or revoked. The inspector keeps a sharp eye out for such conditions as moisture in the sample bottles, sluggish scales, inadequate agitation, carelessness in numbering sample bottles. They make certain:

That the sample taken by the sampler or weigher truly represents the lot sampled.

That proportionate amounts are taken from multiple lots.

That the dipper is rinsed with the product before transferring to sample bottle.

That the sample bottle is tightly closed.

That samples are refrigerated and properly preserved.

That proper records are kept.

That the stick, or tube, reading on farm tanks is made and recorded correctly.

That the tank is level.

That the serial number on the measuring stick corresponds with that on the tank and the conversion chart.

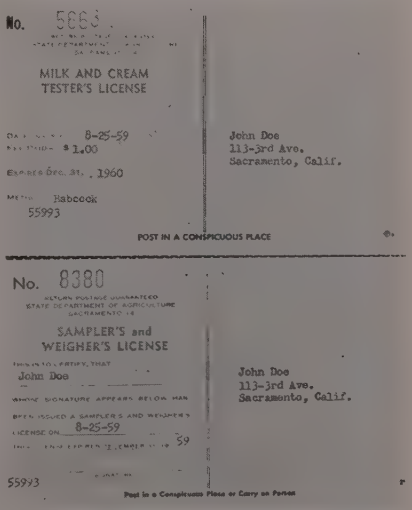
That no bulges have developed in a milk tank.

That no ice has formed.

Presence of any of these conditions could result in incorrect weight or measurement or improper test.

A fat test can be no more accurate than the sample from which it is obtained. This is why the Bureau of Dairy Service has a policy of not testing samples of milk submitted by individuals. Unless we know the sample truly represents the product from which it is taken, the results are meaningless. It is not that the bureau does not have a real interest in the producer's test problems, but we must be absolutely sure the samples are properly taken. However, when such samples are sent to the laboratory for analyses the sender is advised that our representative will contact him regarding his test problems and endeavor to be of assistance in solving them.

Like samplers and weighers, all testers are required to be licensed. The applicant is provided with study material prepared in question and answer form. He is also given printed extracts from the laws and regulations which apply to testing. The examination is both written and oral plus a demonstration. The applicant must prove his proficiency in taking samples, weighing, measuring and testing milk and cream. The examination is generally given in the labora-


No. 5883

MILK AND CREAM
TESTER'S LICENSE

8-25-59
$1.00
Expires Dec. 31, 1960
Babcock
55993

John Doe
113-3rd Ave.
Sacramento, Calif.

POST IN A CONSPICUOUS PLACE

No. 8380

SAMPLER'S and
WEIGHER'S LICENSE

John Doe

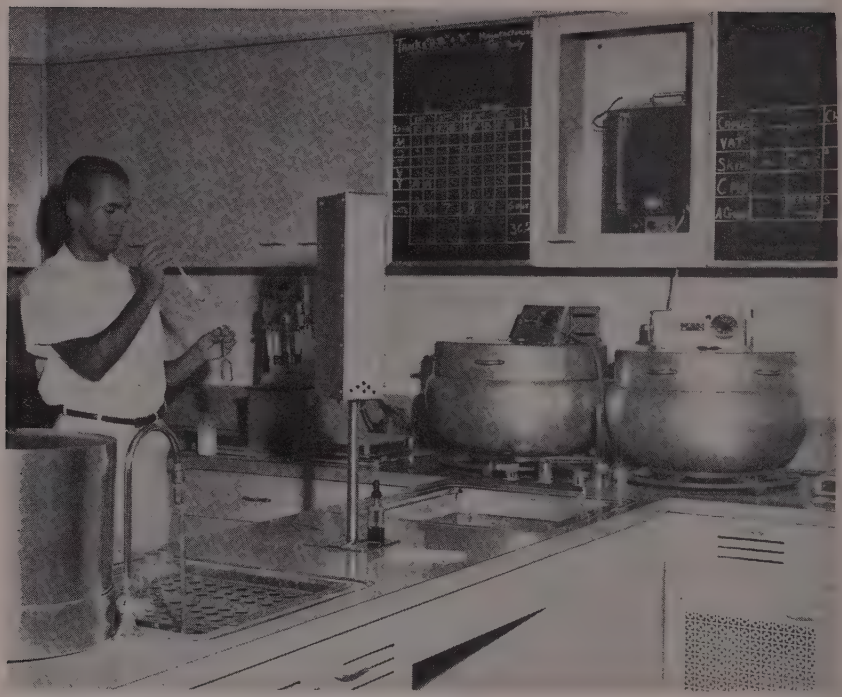
8-25-59

55993

John Doe
113-3rd Ave.
Sacramento, Calif.

Post in a Conspicuous Place or Carry on Person

Licenses issued by Bureau of Dairy Service. Upper license is issued to person qualified to perform the Babcock test. Lower license is issued to person qualified to weigh, sample and measure milk and cream.



Licensed Babcock tester measuring a charge of milk. Note the modern and complete laboratory equipment used for conducting Babcock tests.

tory where the applicant is to be employed and where equipment and arrangement are familiar.

There are three methods of fat testing recognized by the Bureau of Dairy Service regulations: Babcock, Mojonnier and Gerber. At present only the Babcock method is used on producer samples.

The familiar Babcock test, developed by Dr. S. M. Babcock in 1890, has served its purpose well over the years. There have been no basic changes in the technique, but many refinements have been made in the glassware, apparatus and reading devices used. Each step of the test is described in Article 14 of the Administrative Code. Woven through these rules like a bright thread in a piece of fabric is the word "accuracy." The State recognizes only one Babcock test result and that is the *correct* result.

The Babcock test is so well known it needs no description to those in the dairy industry. What most people don't know, however, is the great lengths to which the Bureau of Dairy Service goes to make sure that the reported tests truly represent the lot of milk or cream sampled. For example, the Agricultural Code sets up strict accuracy requirements on all glassware used in fat testing, if the results are to be used as a basis of payment. Every milk or cream test bottle and every measuring pipette used in official milk fat testing is examined for accuracy in the laboratory at Sacramento. If found accurate, within the narrow tolerance allowed by the code, each piece of glassware is permanently marked with "D.B." sandblasted into the side. The initials stand for Dairy Bureau and signify that the test bottle or pipette has been examined and found to be accurate. A charge of $2 per dozen is made for this service and the money collected goes into a special fund which is used to help defray the expenses incurred.

Rejected glassware is returned to the owner together with a statement telling the reason for rejection. The glassware manu-

facturers maintain a stock at Sacramento which is drawn upon for replacement of pieces rejected. In this way the customer always receives his full order of tested and state-marked containers.

Rejections average less than 1 percent of the total glassware checked in the laboratory.

Checking the Work of Licensed Testers

The work of every active licensed tester is checked frequently at irregular unannounced intervals. Bureau personnel have established a thorough routine checkup which includes every phase of this important work. The Agricultural Code requires that all samples of milk and cream be held at 50° F. or lower for 72 hours after testing, if taken daily, and 120 hours if composite. The tester is responsible for the safekeeping of the samples.

All preservatives used in samples must be suitable for the purpose intended and must not be used to the extent of diluting the sample to bring about a lower test. Solid preservative must not exceed 1 percent of the total weight of the sample and liquid preservative is limited to two drops per ounce.

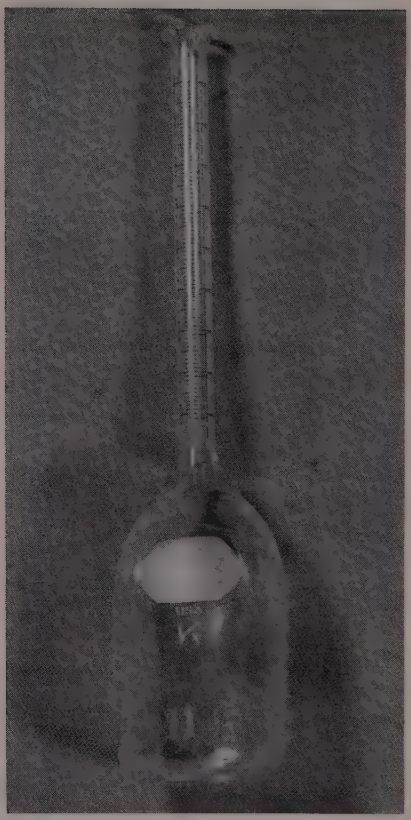
Test bottles, pipettes and glassware are carefully checked to make sure they are clean before use. No milk fat or other grease is permitted. The glassware must sparkle. Graduation marks on the stem must be distinct and easily readable. Bottles which are pitted or badly etched are discarded.

All samples must be thoroughly mixed before being measured. They must be poured from one container to another at least three round trips and must not be over 95° F. at the time of pipetting. It is necessary to shake or blow the last drop from the pippette. Sulphuric acid must be of proper strength and added at 70° F. Samples must be the same temperatures. Thorough mixing is required.

All tests must be centrifuged three times with the addition of hot water after the second and third interval. The centrifuge chamber must be heated to 140-165° F. during operation. Completed tests must be held in a water bath (130-140° F.) for 10 minutes before reading and must be read from the bottom of the fat column to the top of the upper meniscus.

Significant advances have been made in the lighting used for reading the tests. Until the last few years, natural, north exposure

Laboratory technician checking test bottles for accuracy by means of a predetermined mercury column. All bottles used must be checked and certified by the Bureau of Dairy Service.



Close up view of calibrated Babcock test bottle. Note the letters "DB" at base of bottle. This signifies that the bottle has been tested and found accurate within the legal tolerance. For permanency, the letters are sandblasted into glass.

light was considered the most satisfactory but lately some excellent reading-light devices have made their appearance. Artificial light has the big advantage of being uniform. Devices now in use usually employ opaque glass over an electric tube. With this lighting as a background, the fat columns are clearly defined and easily read.

When the tester completes the test, he is required to make a record in duplicate. The original goes to the plant manager. The duplicate is deposited in a metal can which is sealed by the state inspector. No one is authorized to break the seal except the bureau representative. Each sheet must be authenticated by the tester's signature in indelible pencil, showing date of testing and the person or firm buying or selling the product. These records must not be changed, lined out, tampered with or erased. Any changes necessitated by failure to properly record the figures, or for other reasons, must be made by the licensed tester *only*.

If for any reason a sample is retested, the retest record must be deposited in the sealed box. The buyer is required to pay on the retest if the retest shows a variation of more than one-tenth of 1 percent as compared to the original test.

The state inspector checks each tester's work frequently. He selects several samples, usually 20, previously tested and observes the tester as he retests them. Any deviations from required procedure are noted on the check sheet and any defective or faulty glassware is condemned. The results of the tests are compared to the first tests appearing on the duplicate sheet taken from the sealed box. Variations of 1 percent or more on cream and more than .1 percent on milk between the licensed tester's first tests and his retests are considered excessive. The results of such a check must show not more than 10 percent excessive variations between their first tests and the retest, or between their tests and those obtained by the State Dairy Laboratory.

As soon as the check testing is completed, the inspector notifies the producer by letter that a sample of his milk had been retested. Form letters are used for this purpose.

Paragraph 2 of form letter D.S. 138, which is used where excessive variations occur, states that a representative of the depart-

Close up view of licensed tester reading a milk fat column with dividers.

W. C. JACOBSEN
Director

EDMUND G. BROWN
GOVERNOR

STATE OF CALIFORNIA
Department of Agriculture
SACRAMENTO 14

Dear Sir:

A sample of your milk sold to the _____
name of company
at _____ for the period _____
town date
was checked for milk fat content by an official representative of the Bureau of Dairy Service on _____.
date

This check indicated that the original test made by the purchaser was accurate within the tolerance allowed by Division IV of the Agricultural Code of California.

The work of all licensed testers is checked at frequent irregular intervals by a representative of the Bureau of Dairy Service to insure accurate testing. We feel that these findings may be of interest to you.

It also may interest you to know that of 11,396 samples recently retested throughout the State only 103 were considered excessive. Many of the 103 were just .05 over the accepted standard.

O. A. Ghiggoile, Chief
Bureau of Dairy Service

by _____

_____
Title

D. S. 137

Letter used to notify milk producers that their product has been retested and found to be accurate within tolerance levels.

W. C. JACOBSEN
Director

EDMUND G. BROWN
GOVERNOR

STATE OF CALIFORNIA
Department of Agriculture
SACRAMENTO 14

Date:

Dear Sir:

A sample of your milk/cream was retested for milkfat content on _____ at _____ by a licensed milk and cream tester under the supervision of an official representative of the Bureau of Dairy Service of the California Department of Agriculture. The check indicated that the retest did not correspond with the original test so the payment of the product will be made on the basis of the retest.

A representative of this Department will contact the purchaser of your product in order that the necessary adjustment will be made in your account.

The work of all licensed testers is checked at frequent, irregular intervals by a representative of the Bureau of Dairy Service to insure accurate testing. We feel that these findings may be of interest to you.

It also may interest you to know that of 11,396 samples recently retested throughout the State 103 were considered excessive. Many of the 103 were just .05 over the accepted standard.

Very truly yours,

O. A. Ghiggoile
Chief
Bureau of Dairy Service

By_____

_____
Title

D.S. 138

Letter used to notify milk producers that their product, under retest, was not within tolerance levels.

Inspector taking sample of milk from stainless steel milk tank. The sample will be used to check the work of the licensed tester.

ment will contact the purchaser of the milk in order that the adjustment may be made. There are very few adjustments necessary as shown by the figures appearing in the last paragraph. Since the Administrative Code requires payment to be based on the retest where it varies more than one-tenth of 1 percent compared to the original test, the adjustment is made in the records at the processing plant usually *before* the producer receives his statement.

Babcock testing is very exacting work and requires employees to be fast, careful, patient and accurate. The fact that less than one percent of all retests show excessive variations is certainly a tribute to the integrity and skill of men and women doing this work. They can well be proud of this splendid record of consistent, excellent performance on the job. Processor and producer alike can take a great deal of satisfaction in the fact that the important job of fat testing is handled by thoroughly qualified people.

The Farm Tank Program

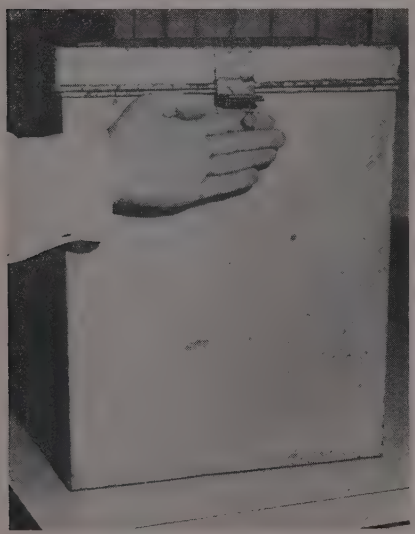
Introduction of the farm milk tank brought with it the need to change the routine of sampling, weighing and measuring milk. This work must be done on the farm.

One of the first jobs cut out for the bureau was to license the tanker truck drivers as samplers and weighers. The next responsibility was to make sure proper agitation was provided and to determine the length of time necessary to thoroughly mix the milk prior to sampling. To secure this information, the inspector has every new milk tank agitated and takes samples simultaneously from five points in the vat; one from each corner and one from the center. These samples are tested and must agree. If they do not, it means that the milk was not agitated long enough (five minutes is usually sufficient on the average tank) or the agitator is going too slow, has the wrong propeller pitch, is too small or is located in the wrong place.

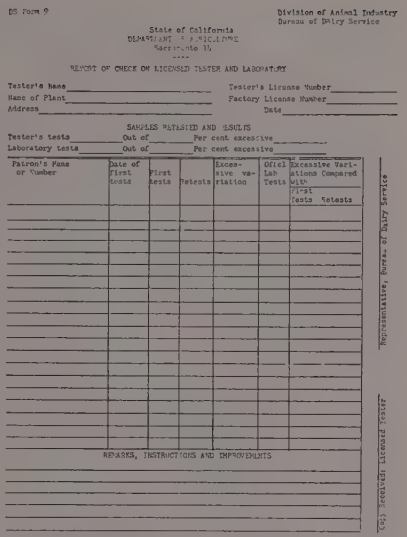
Anything which may contribute to an inaccurate, nonrepresentative sample must be corrected promptly and properly. The county sealer of weights and measures checks the tank for accuracy; that is, he determines that the measuring stick is properly marked or graduated, that the same serial number is permanently marked on the measuring stick, the tank and the conversion chart which is posted in the milk room. The county sealer also checks to ascertain that the tank is level, drainage is complete and that the legs cannot be adjusted after being sealed.

Handling a Test Complaint

Every test complaint made to the bureau receives prompt and individual attention. The inspector studies the past record to see if the test is actually out of line. Then he visits the producer, leaves sample bottles, stirring rod and milk dipper on the farm together with detailed instructions for taking a representative sample. The bottle contains enough preservative to keep the sample in good condition. If the producer is on a daily test basis, only one sample is taken, but if his milk is being tested every eight days or more often than daily, he is instructed in taking adequate amounts of milk each day for the test period.



Metal container (box) used to deposit duplicate test record sheets. Note the lead seal. Each box is sealed by the Bureau of Dairy Service to insure that all records have been inaccessible to unauthorized persons.



DS Form 9

Division of Animal Industry
Bureau of Dairy Service

State of California
DEPARTMENT OF AGRICULTURE
Sacramento 14

REPORT OF CHECK ON LICENSED TESTER AND LABORATORY

Tester's Name _____ Tester's License Number _____
Name of Plant _____ Factory License Number _____
Address _____ Date _____

SAMPLES RETESTED AND RESULTS

Tester's tests _____ Out of _____ Per cent excessive _____
Laboratory tests _____ Out of _____ Per cent excessive _____

Patron's Name or Number	Date of first tests	First Retests	Retests	Excessive variation	Official Lab Tests	Excessive Variations Compared with First tests | Retests

REMARKS, INSTRUCTIONS AND IMPROVEMENTS

Representative, Bureau of Dairy Service

Copy forwarded licensed tester

Form used by Dairy Service inspectors to record work checks of licensed testers.

The samples are taken unbeknown to either the tanker driver or the processor and are held until the inspector calls for them. These samples are tested in the laboratory by the inspector or chemist and the result compared with the test as recorded on the processor's reports. In most instances the two tests agree within the accepted limits; however, any disagreement calls for a detailed unannounced check by the inspector. This involves taking samples on dairy farms well before arrival of the tanker truck. Such samples are official and can be used as a basis of payment.

We are asked frequently why the dairy herd improvement test does not agree with the plant test. This logical question is best answered by quoting a statement on the subject by C. L. Pelissier, Extension Dairyman for the University of California:

"Much misunderstanding exists as the result of tests obtained by the supervisors for the D. H. I. A. with those reported by the dairy plant. It is illogical to make such a comparison and it is not to be expected that complete agreement between these tests will be obtained. The dairy herd improvement test represents one day's production each

month at the farm. On this day the milk from each cow on test is weighed, sampled and tested and then the weighed average test calculated for the entire herd.

"There are numerous reasons why the D. H. I. A. test will not agree with the plant tests:

"1. The plant result for the month is obtained either by analyzing several composite samples made up of the daily samples taken throughout the testing period or several fresh samples taken at intervals throughout the month. In contrast the D. H. I. A. test is for only one day's supply.

"2. The D. H. I. A. test represents the average fat content of all the milk produced at the farm on the testing day. Usually, the milking is conducted with maximum efficiency and completeness the day the supervisor is on hand. The cows are milked out drier on this day and cows about to be dried off are often milked until the supervisor makes his monthly test. Also, the D. H. I. A. tester does not include milk from the cow that has been fresh less than seven days prior to his visit to the farm.

"3. In certain cases, the interval between milkings may be prolonged somewhat on the D. H. I. A. testing day. This would tend to lower the test obtained.

"4. The milk which is sent to the dairy plant is not always the same milk that is tested by the supervisor. Home usage, spillage and calf feeding are some factors which are involved. This fact is clear: the maximum amount of fat is reported by the D. H. I. A. supervisor and subsequent handling of the milk will more likely decrease rather than increase this value."

Checking Records

All the controls on testing, weighing and sampling would be of little value unless the producer's milk check actually reflected the true weights and tests. The final link in the chain of producer protection is record checking. Previously we mentioned a sealed metal box used for deposit of duplicate test record sheets, accessible only to the inspector. The records in the sealed box are checked against producer statements to make certain the correct weight and test are used in calculating the payment to the producer.

Any disagreement in tests between the duplicate test sheet and the producer's statement is listed on a special form and turned over to the Bureau of Milk Control for adjustment. This agency then takes appropriate action to make certain the producer is reimbursed for any underpayment.

The entire fluid milk testing program of the Bureau of Dairy Service, California Department of Agriculture, has always received excellent support from processor and producer alike. Prior to the development of this work, many processors employed field men who spent most of their time trying to explain or adjust testing complaints. These problems are now handled by the inspectors in an impartial way. These men are not working *for* the producer or *for* the processor; they are interested only in seeing that the producer is paid for all the milk he sells and that a correct test is used.

The program has greatly reduced the number of producer complaints on testing. The producer has a better understanding of the legal safeguards which assure him of an honest deal and protect him against any unscrupulous milk buyer. The bureau takes a pardonable pride in the mutual confidence which has been built up between the buyer and the seller through the operation of the fluid milk testing program.

Low Volume Machine Baiting for Rodent Control

By LORING WHITE, Agricultural Commissioner, Modoc County

For many years, the customary method of controlling most field rodents has been to scatter small quantities of poisoned bait by hand in spots close to the rodent's burrow. In accordance with established policy, this method of bait exposure is modified to provide for direct burrow application when circumstances indicate a potential hazard to beneficial wildlife.

This article describes a method of field rodent control with low volume broadcasting of an appropriate rodent bait by machinery. The term "low volume broadcasting," as used herein, means a reasonably uniform application of bait over a rodent infested area at the rate of three pounds or less per acre.

Broadcast applications of rodent baits have been attempted, both in this Country and abroad, under conditions where spot baiting by hand seemed inadequate. Jameson (1958) has discussed methods of broadcasting bait for meadow mouse control. In California, regular broadcast seeding machines have been used successfully to spread zinc phosphide bait for meadow mouse control in Mono County, and fertilizer spreaders have been similarly employed in Modoc County. The first recorded attempt to try anything resembling low volume broadcasting was an experiment in controlling range rodents by plane (Howard, et al., 1956).

During the fall of 1957, we began work to develop a machine that would spread rodent bait faster, more evenly, and with better control than the devices heretofore employed. After a year's work, not only was a satisfactory machine developed, but an important new concept of rodent control was also proved practical in actual field operation.

Description of Machine

The machine (Figure 1) consists essentially of a single-outlet power duster mounted on a jeep. Almost any such duster may be converted in a similar manner if it produces sufficient air blast. Since bait material cannot be fed directly into the fan, like dust, the duster has been altered so the bait feeds through a venturi tube into the airstream four to six inches ahead of the fan. This venturi is simply a piece of 1½- or 2-inch thin-walled tubing cut off at the lower end at a 60-degree angle. The end is centered in the discharge spout, with the angle opening away from the fan, so that the suction created by the venturi feeds the bait directly into the airstream (Figure 2).

Very little agitation is needed to feed bait; too much will grind it. The upper agitator was entirely removed in our machine, and all of the lower agitator screw was cut off except a small portion next to the hopper outlet hole. The regular hopper gate valve was retained, but its operating handle was changed so that it could easily be reached by the jeep driver.

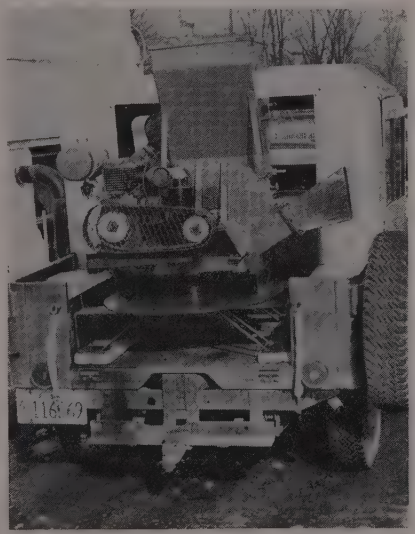


Figure 1. Low volume baiting machine mounted on a jeep.

Figure 2. Close up view of thin-walled tubing. The tubing is cut at a 60-degree angle and is centered in the discharge spout.

Several different types of discharge outlets were tried, and the special fishtail nozzle, (Figure 3), was found to give the most uniform distribution. The entire machine is mounted on a turntable base so that the discharge may be from either the right or left hand side as desired.

Mounted on a jeep or other suitable vehicle, this machine is operated entirely by one man, and is capable of treating from 150 to 250 or more acres a day, depending upon field conditions. The hopper holds about 100 pounds of cereal bait. Effective swath width in still air is about 30 feet, with fairly uniform coverage. Since the discharge can be changed from one side to the other, advantage may be taken of crosswinds, and swaths up to 50 or 60 feet may be obtained with little or no reduction in uniformity of coverage. According to the smoothness of the field, the machine is driven at speeds of from 5 to 15 m.p.h. During 1958, the two machines built and operated by Modoc County covered some 25,000 acres, with very satisfactory results.

Low Volume Application

At the early stages of development, we were using whole oats treated with one ounce of sodium fluoroacetate (Compound 1080) per 100 pounds of bait. This was applied at from 5 to 10 pounds per acre, according to population density. The theoretical coverage at these rates is from 13 to 26 kernels per square yard. This material was used for meadow mouse control instead of the more common zinc phosphide baits because, in the opinion of the writer and local ranchers in mouse-plagued areas, it gave superior results. Unfortunately, lack of time and facilities have made it impossible for us to make more accurate determinations of efficiency by population sampling.

Although the results so obtained were satisfactory to those concerned, we were interested in providing a more substantial margin of safety for other wildlife and domestic animals by reducing the actual amount of rodenticide applied. At this standard dosage level, each pound of bait contains approximately 280 mg. of 1080. Since Ward and Spencer (1947) place the LD100 of 1080 for meadow mice at 0.5 mg./kg., and since these rodents will average more than 20 per kg. (Hoffman, 1958), 10 pounds of standard bait is theoretically sufficient to furnish minimum lethal doses for over 100,000 meadow mice. Infestations seldom exceed 1,000 mice per acre.

The principal reason why such high application rates are necessary with whole grain bait is that the rodent usually removes and discards the hull before eating the kernel. Since practically all of the rodenticide is contained on the surface of the hull, the rodent actually ingests only a portion of the active ingredient.

In discussing this matter, Rollo Talbert, District Supervisor of Rodent and Weed Control, California Department of Agriculture, called our attention to a special "squirrel type" oat groat, manufactured by Triangle Milling Company, Portland, Oregon. This material has been used by some agricultural commissioners for a number of years with very good results. With this type of material, the rodent gets all of the

Figure 3. Close up view showing fishtail nozzle discharge outlet (upper left of photo).

rodenticide instead of merely a portion. After determining that these flattened groats would feed through our machines, we started operational scale tests, using only one to three pounds per acre. In all instances, control appeared better than that obtained by the old 5- to 10-pound rate with whole oat bait.

Since then, we have used this bait exclusively in our machines, and so far, have not found it necessary to exceed three pounds per acre. Instead of applying 1,400 to 2,800 mg. of rodenticide per acre, we now apply only 280 to 840 mg. For reasons obvious to one experienced in rodent control, the hazard to wildlife is reduced to an even greater degree. And, equally important, there is good reason to believe that this low volume broadcasting may prove to be an answer to the problem of secondary poisoning.

Secondary Poisoning

One might incorrectly assume, from some of the questionable implications that have been so carelessly perpetuated in the literature, that the ability to cause secondary poisoning is a special property of 1080, shared by no other rodenticide. It is quite true that canines have a susceptibility to 1080 similar to that of the most susceptible field rodents (meadow mice, ground squirrels and gophers). Yet it is very easy to demonstrate mathematically that it would be very difficult, if not impossible, for a dog or a coyote to obtain a fatal dose by eating poisoned rodents, *if none of the poisoned rodents contained more than its minimum lethal dose.* On this basis, a 44-pound dog (LD 0.1 mg./kg.) would have to consume over 14 pounds of poisoned ground squirrels (LD 013 mg./kg.), or almost nine pounds of meadow mice (LD 0.5 mg./kg.). This would be about 22 Oregon ground squirrels averaging 300 grams each, or 114 35-gram meadow mice.

The above statement is not true, of course, with respect to such rodents as deermice *(Peromyscus)*, which have a much lower susceptibility to 1080.

Conventional methods of spot baiting by hand, unless carefully done by experienced personnel, may enable individual rodents to either consume or pouch many times a minimum lethal dose before the effects of the rodenticide are felt and the rodent stops feeding. Pouching is especially important in their respect. Grinnell and Dixon (1918) record instances where Douglas ground squirrels were found to have as many as 219 barley kernels in their cheek pouches. An equivalent amount of any standard rodent bait in a poisoned rodent would obviously create a serious poisoning hazard. Although this may be an exaggerated example, similar circumstances might easily account for practically all cases attributed to secondary poisoning, if the truth were known.

Low volume broadcasting results in a distribution of from 2.9 bait kernels per square yard at the one-pound-per-acre rate, up to 8.7 kernels per square yard at the three-pound rate. With bait scattered so sparsely, a rodent cannot possibly consume the overdose it could under spot baiting methods. Although this may not completely eliminate all possibility of secondary poisoning, it certainly reduces the probability to an extremely low degree. Suffice it to say that we have encountered no cases of secondary poisoning since using low volume broadcasting.

It is doubtful, however, that low volume broadcasting can be used successfully with rodenticides other than 1080.

Rodenticidal Properties

When strychnine is used as a field rodenticide, the bait must be exposed thickly enough so that the rodent can obtain a lethal dose within a relatively short period of time. Otherwise a sublethal dose may be taken, the rodent is sickened, and thereafter avoids that particular rodenticide or bait material (or both) for at least a few months, as explained by Spencer (1958).

When used at low dosage levels, 1080 is a slower acting rodenticide. According to the U. S. Public Health Service (1956), "In all species there is a variable latent period ranging from 30 minutes to two hours or more between dosing and appearance of symptoms." Furthermore, sublethal doses of 1080, unlike strychnine and other rodenticides, have little or no apparent effect upon the rodent. A detailed account of these important properties of 1080 and their significance is found in the works of Meldrum, Bignell and Rowley (1957), and McIntosh (1958).

When 1080 baits are properly formulated and applied very thinly, each rodent will have plenty of time to search for the bait

and ingest a lethal amount. The ingestion of a sublethal quantity does not stop his feeding. "Bait shyness" is not so apt to develop. The importance of these considerations has been emphasized by Howard (1958).

Comparable authentic data on zinc phosphide seems to be lacking, but field experience indicates that its properties and effects must be intermediary between strychnine and 1080 in this respect. The writer is not sufficiently familiar with thallium sulfate to voice an opinion of the use of that rodenticide.

Ground Squirrels

Although the machine was originally developed for meadow mouse control, we soon had occasion to treat several alfalfa fields infested with a mixed population of meadow mice and Oregon ground squirrels. It was rather surprising to find that low volume broadcasting gave just as good control of the ground squirrels as it did the meadow mice. This type of bait was apparently far more attractive to the Oregon ground squirrel than we had realized, and the searching ability of these larger rodents must be a great deal more efficient than popularly supposed.

Since ground squirrel infestations usually follow a much more "spotty" pattern than the more or less solid infestations encountered in a meadow mouse irruption, subsequent tests were run to determine the efficiency of "strip broadcasting" by machine for ground squirrel control. Broadcast strips, consisting of a regular 30-foot swath, were laid at a three-pound per acre rate. The distance between strips was varied from 20 to 30 feet up to several hundred feet, according to the location of the burrows or colonies and other characteristics of the infestations. We found that Oregon ground squirrels will travel distances up to several hundred feet from their burrows to feed, and that bait placed a good distance from their burrows seems to be accepted as well, if not better, than that placed in close proximity to the burrow openings. Whether this may be true of other species of *Citellus* can only be determined by testing.

The results of these preliminary tests on ground squirrels were confirmed during 1958 by the successful treatment of 2,622 acres on 17 properties.

Conclusions

The practice of spot baiting came into use many years before 1080 was discovered. This method has been continued with 1080 since its advent in 1945. While spot baiting is quite suitable for use with the older types of rodenticides, and has been reasonably satisfactory with 1080 baits, it does not fully utilize the peculiar properties of the latter to the best advantage.

Low volume broadcasting by machines has been developed to make full use of the properties of slower action, unequal specific toxicity and absence of apparent effects at sublethal levels. Field experience has convinced the writer that this method affords the best means so far available to control field rodents without endangering other wildlife, even though it may be a departure from conventional methods.

And even though better machines may be built in the future, our present rather crude conversion of a duster will long be known to Modoc ranchers as "the mouse machine."

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Entomology and Pathology

Editor Note:

The reports listed in this section are reprints of mimeographed announcements released by the Bureaus of Entomology and Plant Pathology during the reporting period covered by this issue of the Quarterly Bulletin.

The reports contain a brief summary of new or unusual discoveries of plant diseases and insect infestations. They are reported herewith in order to record officially important basic data such as time and location of the discovery as well as a brief account of the circumstances surrounding the situation.

For further information, such as subsequent spread of the infestation or disease, control recommendations, current status of the problem, etc., the reader should write directly to the bureau concerned.

BUREAU OF ENTOMOLOGY

New Insect Species in California

Lissorhoptrus oryzophilus Ksl. Rice Water Weevil

Host: *Oryza sativa* (rice)

Order: Coleoptera

Family: Curculionidae

Location: Vicinity of Rice Experiment Station, Biggs, Nelson, Gridley, Butte County; Marysville, Yuba County; Butte City, Glenn County.

Date: July 17, 1959

Collectors: Dr. W. H. Lange and Dr. A. Grigarick, University of California

Degree and Nature of Infestation: Light to medium infestation of adults, larvae, and pupae.

Description: This rice water weevil is about one-eighth of an inch in length and is about half as broad as long. It is similar in appearance to a very small alfalfa weevil in that both have central dark expanded bands extending forward from one-half to two-thirds the length of the elytra onto the pronotum. Ventral pubescence and a thin encrustation gives this weevil a definite aquatic look. Elytra at base one-third wider than thorax, sides very nearly parallel for two-thirds their length, then converging strongly to the narrowed apex. Club of antennae smooth, shining, pubescent only near tip.

The larvae, sometimes referred to as the "rice root maggot" are legless, milky white, similar in appearance to the sweet potato weevil larvae, and one-fourth to one-half inch in length. The head is very small in proportion to the body and is brown. Twin spines protrude dorsally from the larvae, one pair to a segment. These spines are actually spiracular hooks associated with the tracheal system.

The pupa is milky white and is invariably enclosed in a cell of mud which is very smooth on the outside, oval in shape, and is attached to the roots.

Identified by: Miss Rose Ella Warner, U. S. National Museum

History:

Previous known range: Alberta, Canada; Central Eastern and Southern United States; Mexico. This insect has been unofficially reported in Montana.

Native habitat: Probably Eastern, Central and Southern United States.

Other recorded hosts:

Paspalum urvillei Steud, "Vasey grass"

Paspalum larrangagai Arech—*Paspalum urvillei* Steud

Paspalum plicatulum Michx "Brownseed Paspalum"

Cyperus albomarginatus Mart. & Shrad. (*C. flavicomus* Gray) (No common name for this sedge)

Echinochloa crusgalli (L.)—Barnyard grass

Dasiops sp.

Host: *Prunus armeniaca* (apricot)

Order: Diptera

Family: Lonchaeidae

Location: Ramona, San Diego County

Date: August 2, 1945 *

Collector: Dean F. Palmer

Degree and Nature of Infestation: Larvae only

Description: This fly has a shiny blue-black lustre on thorax and abdomen; its wings are transparent and appear somewhat oversize. Its very large eyes, which comprise almost the entire head capsule, are flattened and only slightly convex. The fly is further characterized by large black halteres and white squama, and is approximately half the size of the common housefly. The maggots are chiefly characterized by having a caudal section which is higher than broad, with a pair of prominently projecting black spiracles. Each spiracle has a dorsal spine which characterizes this type of maggot.

Identified by: J. Frank McAlpine, Insect Systematics and Biological Control Unit, Ottawa, Canada

History:

Previous known range: See below

Native habitat: Texas, Arizona, California

Other recorded hosts: *Juglans* sp. (walnuts)

Potential Economic Importance and Recommendations: Subsequent collections of this fly have prompted the Bureau of Enomology to issue this report. Specifically, these collections are from the Barbizon Ranch, Alpine, San Diego County, and the Robert Kirk Ranch, Redding, Shasta County. Specimens have been reared from apricots taken from both infestations and a comparison by Mr. J. Frank McAlpine, a Lonchaeid expert, states that they are the same species and at present are undescribed. Mr. McAlpine further states that he has seen a number of specimens which he considers the same species reared from walnut husks from Texas, Arizona, and Southern California. Mr. McAlpine

* This collection has precedence over others because it is the first record of Lonchaeid larvae attacking apricots in California. In all probability the same species is involved.

has studied a Lonchaeid reared from walnut husks from Sonoma in 1954 and confirms it as the same species. Walnuts from San Joaquin and Tehama Counties have also been associated with a species of *Dasiops*. However, the specific determination cannot now be confirmed.

Life History: The annual history and the feeding habits of this fly are as yet imperfectly known. Eggs and larvae put in a rearing cage on the first of July produced adults between July 22d and August 1st. Probably two generations a year are indicated, although the actual number could easily be greater.

Infested Area Extensions—Previously Reported Pests

Psylla Pryicola, pear psylla

Host: *Pyrus communis*

Order: Homoptera

Family: Psyllidae

Location: Atascadero, San Luis Obispo County, California

Date: June 18, 1959

Collector: R. M. Drake, San Luis Obispo County Agricultural Commissioner's Office

Degree and nature of infestation: Light infestation of nymphs on leaves

Remarks: This collection marks the southern limit of pear psylla recorded in California, and is 150 miles south of the last extension reported from Santa Clara County. A pear psylla collection of July 20, 1959, file No. 59G22-1, by J. L. Joos of the County Commissioner's Office at Linden on *Pyrus communis* is the first recording of this pest in San Joaquin County.

Cotinis texana, green fig beetle

Order: Coleoptera

Family: Scarabaeidae

Host: *Ficus* sp.

Location: Bakersfield, Kern County, California

Date: July 22, 1959

Collector: J. E. Bridges, Kern County Agricultural Commissioner's office.

Degree and nature of infestation: Adult found alive on fruit.

Remarks: This is the first collection of the green fig beetle north of the Tehachapi Mountains.

BUREAU OF PLANT PATHOLOGY

Report of New or Unusual Plant Pathogen

Type of Pathogen: Fungus

Host: Rhododendron (*Rhododendron* 'Harvest Moon')

Scientific name of casual pathogen: *Chrysomyxa ledi* (Alb. and Schw.) var. *rhododendri* (de Bary) Saville.

Common name of disease: European rhododendron rust.

Case History:

Location: Fortuna, Humboldt County

Date: July 23, 1959

Type of Planting: Nursery (Retail)

Collector: Keith Miller and Frank Wetherbee, Humboldt County Department of Agriculture, and David Bingham, California Department of Agriculture

Identified by: Thomas G. Scandone, Bureau of Plant Pathology, California Department of Agriculture

Nature and Degree of Infestation: Found on the undersurfaces of many leaves on two rhododendron plants, both *Rhododendron* 'Harvest Moon'.

Description of Disease (including identifying characteristics): Clusters of yellow to orange spore-bearing bodies occur on the undersurfaces of the rhododendron leaves. When examined by microscope, the spores from these bodies are broadly ellipsoid or nearly globoid in shape with measurements that average about 25 to 18 microns.

General Information and Previous History:

Known Distribution:

California: Marin, Mendocino, and San Francisco Counties.

Other States: Washington and Oregon

Elsewhere: Canada and Europe

Type of Pathogen: Flowering Plant

Host: Tomato (*Lycopersicon esculentum* Mill.)

Scientific Name of Causal Pathogen: *Orobanche ramosa* L.

Common name of disease: Branched broomrape

Case History:

Location: Ryde, Sacramento County

Date: July 10, 1959

Type of Planting: Commercial (fruit)

Collector: Stephen P. Carlson, Farm Advisor, Sacramento County

Identified by: Carl W. Nichols, Bureau of Plant Pathology, California Department of Agriculture

Nature and Degree of Infestation: Many tomato plants were found to be parasitized by branched broomrape throughout an area of about six acres in one 29-acre tomato planting, and scattered plants were infected in a one-acre area of an adjoining 27-acre planting. Both plantings belonged to the same grower.

Description of Disease (including identifying characteristics): Pale to bright yellow or straw-colored clusters of stems or branches are present at the bases of the parasitized tomato plants. When the roots and crowns of the parasitized tomato plants are exposed, it is found that the broomrape plants are attached to the tomato roots. Numerous pale blue flowers are produced on the broomrape branches and from the flowers are developed capsules containing large numbers of tiny seeds which are about the size of fine grains of sand. The broomrape plants, at first rather light colored, become dusky tan to brown with age and the seed capsules open and release the seeds.

Parasitized tomato plants may vary in appearance from a plant that appears to be normal to a

plant that is stunted, shows evidence of wilting and dying, and has a poor yield of fruit.

(For additional information on symptoms and signs see Calif. State Dept. Agric. *Bulletin* 42 (2): 45-51. 1953.)

General Information and Previous History:

Known Distribution:

California: Alameda County

Other States: Eastern United States (Kentucky, Illinois, New York, Wisconsin, and other states).

Elsewhere: Egypt, Europe, Asia

Type of Habitat: No specific habitat limitations are known, but the parasite is known to spread most rapidly in areas that are subject to flooding.

Known Host Range: The parasite has been seen in California on tomato (*Lycopersicon esculentum*); lettuce (*Lactuca sativa*); cucumber (*Cucumis sativus*); hairy nightshade (*Solanum sarachoides*); spiny clotbur (*Xanthium spinosum*); redroot pigweed (*Amaranthus retroflexus*); poison hemlock (*Conium maculatum*); lambsquarter (*Chenopodium album*); biennial wormwood (*Artemesia biennis*); an unidentified mustard (*Brassica* sp.); cocklebur (*Xanthium canadense*); shepherd's-purse (*Capsella bursa-pastoris*); white sweet clover (*Melilotus alba*); and yellow sweet clover (*M. indica*). (For additional hosts reported outside of California see *Bulletin* article cited above.)

Importance and Recommendations:

This pest is of limited occurrence in California, having been known only in Alameda County prior to the current find. Experience with the branched broomrape in Alameda County tomato fields usually has been that the cropping potential of infested fields is reduced up to about 50 percent in comparison with noninfested fields.

Methods to be used in the possible eradication of the parasite in Sacramento County are being explored.

Sur la chlorose infectieuse des Citrus

[On infectious chlorosis of citrus]

Note by M. Trabut *in* Comptes rendus de l'Académie des sciences, Paris, 156:243-244, 1913.
Translated by LEO J. KLOTZ, Plant Pathologist, University of California, Riverside, California [1]

FOREWORD

By GILBERT L. STOUT, *Chief*
Bureau of Plant Pathology,
California Department of Agriculture

Virus diseases of citrus have great importance in California's agricultural industry. This is readily apparent when one considers the tremendous loss caused by the quick decline (Tristeza) virus disease of citrus and the cost of our continuous fight against it. It is thought to have been brought into the United States in infected citrus trees or citrus propagating material in which symptoms of the disease were not apparent or recognized. There also are other serious virus diseases of citrus. In order to protect California citrus from other serious virus diseases not now known to be present in the State, all citrus trees or propagating wood imported into California from foreign countries are now tested by indexing on susceptible "guinea pig" test trees to insure that they are free of any such viruses.

Thus, Dr. Klotz's translation of M. Trabut's article on an "infectious chlorosis of citrus" recovered from citrus originating in England and Australia is of current, as well as historical, interest. In Dr. Klotz's letter to us with which he sent this very excellent translation, he says:

"I believe it [M. Trabut's article] is the first account of a virus disease of citrus in which the investigator actually proved transmission by grafting. This antedates similar work on psorosis [in California] by 20 years.

"It is possible that the malady he [M. Trabut] described and transmitted was Infectious Variegation Psorosis."

In orange groves some trees have shown a serious chlorosis which develops in intensity for two or three years and finally kills the trees.

This chlorosis has very characteristic symptoms which easily distinguish it from common chlorosis resulting from an intoxication by soil salts.

Its principal distinguishing character is its transmissibility by grafting: for this reason the name "chlorose infectieuse" [infectious chlorosis] is proposed.

During the dozen years I have observed this malady all grafts taken from a diseased tree produced only chlorotic trees in the second year. These trees decline more or less rapidly and finally die.

The rootstock is also contaminated and wastes away with the same disease after the [diseased] scion is cut off. If the contaminated rootstock is regrafted the malady passes into the new scion.

I have observed the infectious chlorosis on two varieties—a Washington navel orange from England where it had been cul-

[1] The translator wishes to thank Mr. Jules Rodigou, District Nursery Inspector, Bureau of Nursery Service, California Department of Agriculture, who compared this translation with M. Trabut's original article and made certain suggestions and corrections, which are incorporated in the translation.

tivated in a glasshouse and a Siletta orange that came as a graft from Australia. But the disease can appear on other cultivated citrus [varieties].

The infected grafts grow vigorously the first year; during the second year one observes extraordinarily abundant blooming followed by a very pronounced granulation in the fruit. At that time one notes the first symptoms of decline; the leaves turn yellow but in a very special way; the decolorization starts along the midvein in a width of 3 to 5 mm. on each side and then follows the lateral veins. The destruction of chlorophyll continues and soon all the leaf is decolorized.

This inoculable chlorosis does not appear to have been described in America where citrus diseases have been the object of serious research by plant pathologists; but [the disease] is analogous with the infectious chlorosis of Malvaceae (Kön. Preuss. Akad. Wiss. 1906) of von Baur, which in truth, is only an inoculable variegation.

In practice it is easy to avoid this disease which is transmissible only by grafting; numerous experiments leave no doubt of that.

The nature of the contagion remains to be determined. I have searched in vain for a bacterium in the phloem and the cells, and in the decolorized areas. For the moment one can accept the hypothesis of Baur; the disease results from a phytotoxin secreted by an organism which escapes detection by a microscope but which manifests itself following inoculation [by grafting].

Portable Device for Egg Candling Outside a Dark Room

By HAROLD J. RYAN, Agricultural Commissioner, Los Angeles County

A black cloth hood constructed to fit over the end of a portable egg candling unit can be used to overcome unfavorable light conditions at a substantial saving of time. A properly made hood effectively shuts out enough light to permit a thoroughly accurate candling operation. Inspections are thus made possible at open-air markets, roadside trucks, and brightly lighted supermarkets.

In packing plants, inspections can be made at each stack of eggs, saving the time of carrying samples back and forth to a candling booth. The saving of time facilitates more thorough inspections. Accuracy in candling is an important factor in providing better protection to the public and to the industry, and in the preparation of court evidence.

One end of the hood is slipped over the end of the candler, as shown in the accompanying sketch included, and is held snugly in place by three elastic strips sewn into the end of the hood opening. The egg is held inside the hood and observed through the rectangular opening in the top.

The idea, originated and developed by Los Angeles County Agricultural Inspector James D. Dyer, won him a cash award of $94.30 from the county suggestion award board, created by a recent county ordinance for the purpose of evaluating employee suggestions calculated to save time and labor, or to improve tools and equipment. The unit can be made for about $5.

Instructions for Making Light Hood For Egg Candler

Materials Required: (Designed for candler approximately 8¼" high and 7" wide.)

1 piece, lightweight black duck material, 31" x 33".
4 pieces, ⅛" x 12" metal rod.
3 pieces, ¼" x 9" black elastic.
3 snap fasteners.
2 pieces, ¾" x 4" cloth stays.

Construction Procedure:

Figure 1. Fold material on long axis, matching notches.

Figure 2.

a. Cut 2" x 3" window on vertical centerline with lower edge of window 8" from fold of material. Turn edges in and stitch on top.

b. Make four vertical casings, ½" wide, to hold rods, as indicated. Outer casings should be 8" apart.

Figure 3.

a. Hem folded edge of material 1½" from fold.

b. Insert rods in casings.

c. Turn in upper edges of material and stitch on top.

d. Sew ends of folded material together from top to point 0.

Figure 4. Shows arrangement of elastic bands, stays, and snap fasteners on completed hood.

Figure 5. Shows enlarged detail of bottom portion of Figure 4.

a. Sew elastic bands to right side of open seam of hood as indicated. (About 2½" of each elastic band should be sewn to hood.)

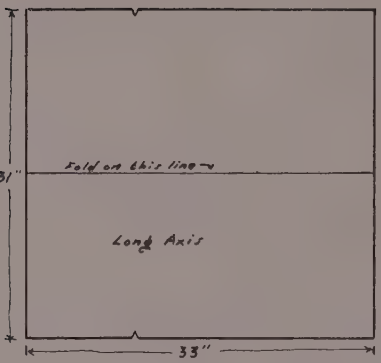
b. Sew cloth stays to left of open seam of hood as indicated, to retain but allow free passage of elastic bands.

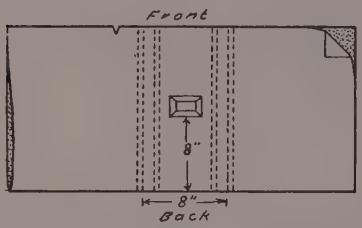
c. Attach male portions of snap fasteners to elastic bands and female portions to hood as indicated. Male and female portions of each fastener should be 2½" apart when hood is laid out flat.

SKETCH AND INSTRUCTIONS
FOR MAKING

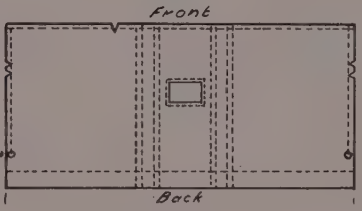
EGG CANDLING HOOD

DEVISED BY
COUNTY AGRICULTURAL INSPECTOR
JAMES D. DYER
OF
LOS ANGELES COUNTY

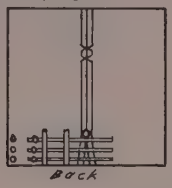




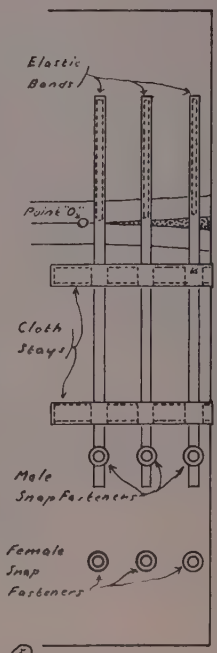
② Material Folded, Window Cut, and Vertical Casings Sewn.



③ Edges Hemmed, Window Stitched and Rods Inserted in Casings.

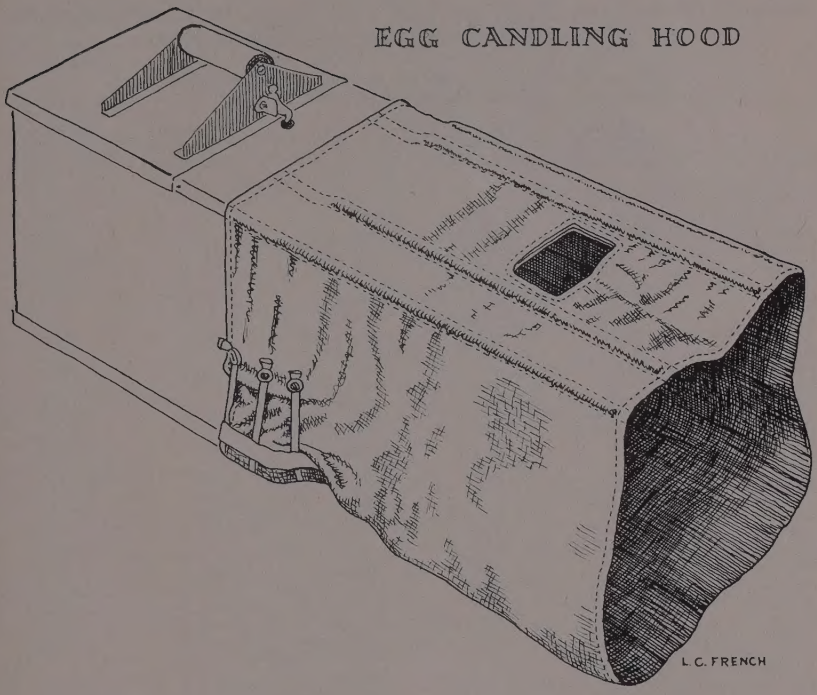


④ Bottom View



⑤ Enlarged Detail of Fig ④

EGG CANDLING HOOD



RANKING OF RELATIVE IMPORTANCE OF CALIFORNIA IN THE PRODUCTION OF SELECTED AGRICULTURAL COMMODITIES—1958

Prepared by California Crop and Livestock Reporting Service
Sacramento, California, September 24, 1959

Commodity	Rank in production among states	Percent of U.S. production in California
Over 90 percent were produced here:		
Almonds	1	100.0
Artichokes	1	100.0
Olives	1	99.8*
Nectarines	1	99.8*
Pomegranates	1	99.3*
Figs	1	99.1*
Lemons	1	98.8*
Prunes, dried	1	98.6
Dates	1	98.5*
Persimmons	1	96.2*
Ladino clover seed	1	95.5
Walnuts	1	92.2
Avocados	1	91.8
Brussel sprouts	1	91.3
Grapes	1	90.6
California produced 50 to 90 percent of these:		
Plums	1	88.7
Garlic	1	84.4*
Apricots	1	83.3
Honeydews	1	76.9
Broccoli	1	63.0
Tomatoes	1	59.2
Celery	1	58.7
Lettuce	1	54.0
Cantaloups	1	52.7
Asparagus	1	51.7
Chili peppers	1	---[1]
In this group, California grew 25 to 50 percent:		
Pears	1	49.8
Peaches	1	45.7
Green lima beans	1	45.7
Cauliflower	1	43.9
Alfalfa seed	1	42.7
Strawberries	1	40.2
Carrots	1	36.9
Spinach	1	28.8
Green peppers	2	27.3
Sudan grass seed	2	26.8
These were important—10 to 25 percent:		
Rice	2	24.9
Sugar beets	1	23.9
Vetch seed	2	23.2
Dry beans	2	21.6
Hops	2	18.6
Oranges	2	18.4
Turkeys	1	17.4
Honey	1	16.8
Onions	3	16.1
Barley	2	14.3
Cotton lint	2	13.9
Cherries	4	13.9
Alsike clover seed	4	13.5
Cottonseed	2	13.0
Cabbage	2	11.4
Potatoes	3	11.1
Of these, California produced less than 10 percent:		
Eggs	2	8.0
Apples	5	7.6
Snap beans	5	7.6
Wool	3	7.6
Watermelons	4	7.2
Farm chickens	2	6.6
Sheep and lambs	2	6.5
Milk	4	6.1
Sweet potatoes	6	5.8
Hay	4	5.7
Grapefruit	4	5.1
Cattle and calves	9	4.2
Flaxseed	4	4.2
Sweet corn	6	3.9
Broilers	11	2.9
Green peas	12	2.9
Grain sorghums	6	2.5
Mustard seed	2	1.3
Rye	30	1.0
Hogs	25	0.6
Wheat	20	0.6
Field corn	26	0.5
Oats	25	0.4
Dry field peas	7	0.4
Mohair	6	0.2

* Based on Census of Agriculture 1954.
[1] Production for United States not available.

CALIFORNIA CASH FARM INCOME REACHED RECORD HIGH IN 1958

A preliminary figure for California cash farm income appeared on the cover of Volume 48, Number 2. This figure was subsequently revised to an all-time record of $2,852,792,000 and surpasses the previous record high of $2,837,065,000 set in 1956.

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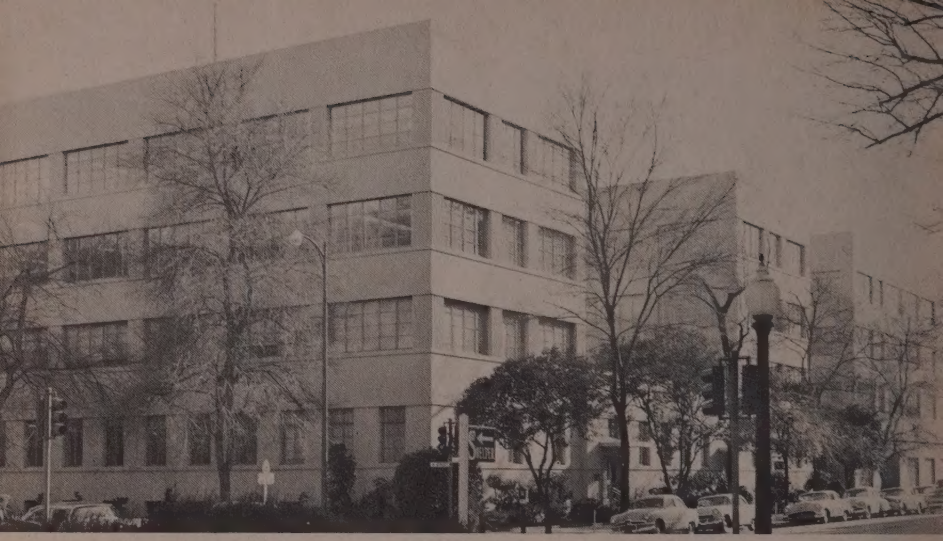

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Bureau of Agricultural Statistics—2056
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Bureau of Fruit and Vegetable Standardization—3831
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P. V. Stay, Assistant Chief

Bureau of Weights and Measures—3511
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Burris G. Wood, Assistant Chief

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